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CHINA: ENERGY

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ENERGY INDUSTRIES MAKE HEADWAY IN 1987

40130039 XINHUA Domestic Service in Chinese 0631 GMT 10 Jan 88

[Article by reporter Wu Shishen]

[Excerpts] Beijing, 10 Jan (XINHUA)--While maintaining a stable increase in output, China's energy industries have made steady strides and entered a new stage of self-development.

The year 1987 witnessed a rapid growth in our electric power industry, a key component of our country's energy development program. The power-generating capacity added in the year exceeded 8.1 million kilowatts, reaching a record high. The total power-generating capacity nationwide broke the 100 million-kilowatt mark, ranking China among the top in the world. Total power output stood at 493 billion kilowatt-hours. This was 9.7 percent above the preceding year's output, reaching the highest increase rate ever registered. In the coal industry, production of coal exceeded 900 million metric tons for the first time. The actual output reached 925 million metric tons, continuing the trend of a sustained big increase for 6 years running.

Despite difficult conditions, the petroleum industry passed the seventh year of stable growth with the production of 134 million metric tones of crude oil and 13.7 billion cubic meters of natural gas. The burgeoning petrochemical industry grew quickly. Our crude oil processing capacity became the sixth largest in the world. A total of 97.05 million metric tons of crude oil was processed, and the output of natural gas, kerosene, diesel oil, and lubricants totaled 46.4 million metric tons, surpassing the preceding year's records by 6 and 5 percent respectively.

In 1987, the Daqing Oil Field continued to maintain its crude oil production at the steady high level of some 55 million metric tons as a result of tapping its own production potentials. During the past 7 years, the petroleum industry has carried out a production contract system at all levels and relied on production of extra-quota crude oil to earn some 22 billion yuan for new oil reserve prospecting and exploitation. Now, over one-half of the investment in transforming existing oil fields and inn prospecting for and exploiting new oil reserves has been made from self-provided funds. Seabed oil prospecting and exploiting projects have been financed mainly by foreign capital. Up to now, foreign capital acquired for this purpose has amounted to

$2.2 billion. In 1987, 710,000 metric tons of oil were pumped from the sea. The "oil giant" learned to "walk by himself" through reform and opening to the outside world.

To carry out reform, the coal industry has used two methods. In the past, the coal mines whose products were distributed by the state were so strictly "controlled" that they did not even have the power to decide on building a toilet. After the introduction of the general contract system, these coal mines gained decisionmaking powers in managing their personnel, financial affairs, materials, production, supply, and sales. In 1987, all the coal mines further improved and perfected their internal contract policies and introduced incentive mechanisms to encourage competition. The Yangquan Mining Bureau fixed the basic figures for contracts, and within a year or so, it changed its operation results from a loss of some 10 million yuan to a profit of more than 1 million yuan. While implementing the "contract" system, the coal industry has also adhered to the reform principle of "joint efforts by the state, collectives, and individuals and simultaneous development of big, middle, and small coal mines." This has resulted in a system where coal mines can be operated at different levels, and now the output of locally run coal mines has outstripped those whose products are distributed by the state. The past 4 years have witnessed an increase of 200 million metric tons in nationwide coal production, compared with the increase of only 100 metric tons during the 6 years from 1978 to 1983. The situation of coal supply shortage has undergone an historic change, and what is more, each year our coal is being exported to over 20 countries and regions of the world.

The electric power industry has promoted the development of numerous power projects. Changing the situation of "monopoly in building power projects" is a major reason for the breakthrough in developing the electric power industry. In recent years, the state has unequivocally announced that the electric power industry should be taken as the focus for developing energy industries and has implemented the principle that the investor in an electric power project is entitled to use the electric power generated. This has aroused the initiative of various localities and departments to develop electric power projects. In 1987, an unprecedentedly good situation appeared with "numerous units developing electric power projects." Funds raised for this purpose from local sources amounted to more than 2 billion yuan. The state issued some 2 billion yuan in electric power development bonds for the first time. The agreements signed for use of foreign funds had come to an accumulated total of about $3 billion. In Jiangsu and Guangdong, the new power generating capacity created and put into operation by using self-raised funds each reached about 1 million kilowatts, equivalent to their respective total capacity installed during the entire Sixth 5-Year Plan. This averted losses of more than 10 billion yuan in production value that would otherwise have been suffered because of electric power shortages. Today, the "sources" of funds for the electric power industry have developed from pure state investment to over a dozen channels, which include substituting loans for appropriations, extending loans, raising funds locally, issuing electric power bonds, and using foreign capital. Accordingly, the funds made available for

for developing electric power projects increased from 4.9 billion yuan in 1978 to some 16 billion yuan in 1987.

The petrochemical industry has opened a new avenue. Established in the midst of reform, the China National Petrochemical Corp. has energetically explored new ways to "run itself as an economic entity," trying to include in its functions the work of production, construction, scientific research, education, sales, and foreign trade. As a result, the petrochemical industry has been able to mount a new stage every year. In 1987, the petrochemical industry completed 8 billion-yuan worth of capital construction and technological transformation with 70 percent of the investment in these projects self-provided. The operation of big ethylene projects such as the 300,00-metric-ton Qilu and Yangzi ethylene projects has doubled the nation's ethylene production capacity. Now, the annual output value of the petrochemical industry has reached 35.4 billion yuan, contributing about 16 billion yuan in profits and tax revenue to the state. This industry has become one of the important "financial sources" of the national economy.

While China's energy industries have learned to talk by themselves and entered into a new stage of self-development, we should not forget their "dark side." Their average annual growth rate is below the speed of development of the national economy as a whole. In 1987, there was still a shortage of from 60 to 70 billion kilowatt-hours of electric power in the country. In addition, insufficient construction funds will remain a major obstacle to the development of energy industries in the days to come. Facing the opportunities and challenges created by the reform and open policies, however, these industries have changed from reliance on state investment as their "feed" to reliance on state policies to "grow and mature" by themselves. As they are taking such a course of reform, the road ahead will be wider and wider.

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POWER OUTPUT PLACES NATION IN FIFTH PLACE WORLDWIDE

40130021 Beijing RENMIN RIBAO in Chinese 21 Oct 87 p 1

[Text] "Today, China has a total installed power generation capacity of 93,820,000 kilowatts and a yearly out of 449.6 billion kilowatt-hours, placing it in fifth place worldwide behind the United States, the USSR, Japan, and Canada. It is estimated that by the end of this year [1987], total installed capacity will exceed 100 million kilowatts and output will be more than 480 billion kilowatt-hours." This statement was made by Vice Minister of the Ministry of Water Resources and Electric Power Feng Xiang today at an international conference on high-voltage power transmission being held in Beijing to Chinese and foreign hydropower experts.

China's electric power industry has a history of more than 100 years, but in the 70 years prior to 1949 the development of the industry was extremely slow and the level of technology backward. In that year, the nation's total installed capacity was a mere 1.85 million kilowatts; the generation equipment was all medium to low-voltage, small-capacity sets. The entire country had only a few 154-kilovolt and 220-kilovolt power lines and the power grids were not integrated. In 1949, the yearly output was only 4.3 billion kilowatt-hours, which ranked China 25th in the world.

Since the beginning of the 1980's, China has followed a policy of adopting large generators, building large power plants and stations, accelerating the development of thermal power, selecting favorable river sections for the large-scale development of hydropower, suitably developing nuclear power, promoting high-tension, large-scale power grids, and actively promoting the development of other [alternative] energy sources by selecting measures suited to local conditions to step up the growth of the electric power industry. Today, there are 102 hydropower stations and thermal power plants of 250,000 kilowatts or more, including 45 facilities of 500,000 kilowatts or more, and 2 hydropower stations and 9 thermal power plants of more than 1 million kilowatts; total installed thermopower capacity is 64.32 million kilowatts, of which generators with a capacity of 100,000 kilowatts or more represent 51.4 percent. Total installed capacity for hydropower is 29.5 million kilowatts. The share of hydropower and thermal power in the overall picture is 29.5 percent and 70.5 percent respectively. A start has been made to develop nuclear power with pressurized-water reactor power plants now being built at Qinshan in Zhejiang Province and Daya Bay in Guangdong Province.

Along with the growth in installed capacity, the power networks themselves have been undergoing continuous development. Today, the nation has built 12 power networks of more than 1 million kilowatts each.

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PROSPECTS SAID GOOD FOR GROWTH OF NATION'S ENERGY SECTOR

40130026a Beijing KEJI RIBAO in Chinese 16 Nov 87 p 1

[Article by reporters Tang Shifen [0781 1102 5358] and Han Yuqi [7281 3768 3825], and correspondent Tao Gao [7118 6964]]

[Excerpts] What is the outlook for the nation's energy sector? On 25 November a joint discussion meeting was sponsored by the Chinese International Science and Technology Conference Center and the Chinese Energy Research Society. Representatives from the State Science Commission, State Planning Commission, State Machine Building Commission, Chinese Academy of Sciences, Ministry of Chemical Engineering, Ministry of Coal, Ministry of Water Resources and Electric Power, Ministry of Metallurgy, Ministry of Transportation, and China Petrochemical Corporation, technical attaches from more than 10 countries, and several dozens of technical experts attended the meeting.

Based on an introduction given by the Energy Conservation Bureau of the State Planning Commission, China has abundant energy resources. It leads the world in coal and hydroelectric resources. The prospect of petroleum and natural gas is also very promising. In 1986, China produced 890 million tons of coal, 449 billion kilowatt-hours of electricity and 130 million tons of oil. It basically met the requirement to sustain the economic growth. The energy production and conservation picture this year is also encouraging. According to a report, the national gross product will reach 1,120 billion yuan by 1990. Coal production will reach 1 billion tons; 550 billion kilowatt-hours of electricity will be generated and 150 million tons of oil will be produced. By 2000, the country is expected to produce 1.2 - 1.4 billion tons of coal, 1,100 - 1,200 billion kilowatt-hours of electricity and more oil. As for energy conservation, China continues to save energy by adjusting its industry and produce structures. In addition, energy management is being strengthened and energy conserving technology is being promoted. We are also taking other effective measures such as combining electric power generation and heating, centralizing the heating supply, and improving the efficiency of the heating system.

It was also announced at the meeting that China will host the "International Energy Management and New Energy Conservation Technology Society Conference and Exhibition" in Beijing in September 1988. This meeting has been approved by the State Science Commission.

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NUCLEAR POWER COULD PLAY MAJOR ROLE BY 2040

40130026b Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 1 Dec 87 p 8

[Article by Guo Xingqu [6753 2502 3255]]

[Text] Because of the limited availability of renewable energy resources, the consumption of fossil fuels will peak and then fall by the beginning of the next century. Based on a calculation made by the author, nuclear power will become a major energy source in China at approximately 2040.

China will complete the 300,000-kW Qinshan Nuclear Power Plant and the Guangdong Nuclear Power Plant which has two 900,000-kW reactors by 1990 or soon after. Since nuclear technology is already mature, it is possible for China to produce a quarter or a third of its power by nuclear technology 30 or so years after 1990, and then to generate more than 50 percent of its power by nuclear plants by 2040.

The present pressurized-water reactor can only utilize 0.5 percent of the uranium. The neutron reactor being developed can utilize about 70 percent of the uranium. This makes it economically worthwhile to exploit low-grade uranium ores. Breakthroughs have been made recently with the fast breeder reactor which uses metallic fuel. In order to meet the energy demand by the middle of the next century, the most feasible approach is to develop fast breeder reactors. In areas where nuclear energy is just being developed, such as India, Argentina, Brazil, and South Korea, based on the lessons learned in developed nations, the focus is to develop fast breeder reactors in order to save money. In order to meet the need in the far future and to fully utilize nuclear energy, a few developed countries, are working on high-temperature gas-cooled reactors and hybrid fission-fusion reactors, in addition to concentrating their efforts on developing fast breeder reactors.

In order to solve the energy shortage in certain areas in China, we should formulate a feasible long-ranges plan to accelerate the development of nuclear power.

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RETHINKING ENERGY BASE CONSTRUCTION FOR GREATER EFFICIENCY

40130026c Beijing GUANGMING RIBAO in Chinese 28 Oct 87 p 3

[Article by Ma Haibing [7456 3189 0356]: "Developing Energy-Intensive Industries in Energy Bases"]

[Excerpt] After a year of survey and study, researchers at the Industrial and Economic Institute of the Chinese Academy of Social Sciences recently suggested that as an important policy, energy intensive products should be rapidly built in energy bases. Associate researchers Hong Huiru [3163 1920 1172] and Huang Zaiyao [7806 6528 1031] discussed their views with this reporter.

These experts pointed out that Shanxi, western Inner Mongolia, Ningxia, north of Qinling in Shanxi, and western Henan are the largest bases of commercial grade coal in China. In the past, because the distribution of energy resources was neglected when the locations of energy-intensive industries were decided, any energy-intensive metallurgical and chemical plants are located along the energy-starved coastal region. The amount of coal transported from these bases to the coastal area is increasing every year. Due to difficulties in transportation, the productivity of both energy bases and energy-intensive industries is not utilized to its full extent. For example, Shanxi has stockpiled 25 million tons of coal. Coal is produced in western Inner Mongolia and Ningxia based on the amount that can be shipped. Because of a shortage of coal and electricity, 20-50 percent of the production capacity of energy-intensive industries in Liaoning and Jilin is idle. At the same time the demand for energy-intensive products grows rapidly. In the Sixth 5-Year Plan, the government spent 29 billion dollars in hard currency to import energy-intensive products. It exceeds the total amount of petroleum exports in the same period.

Under the circumstance, one of the major tasks in the construction of an energy base is to selectively build energy-intensive industries and to convert coal into electricity locally in order to be able to ship out energy-intensive products instead of the coal. Thus, it not only makes it easy for the east coast to concentrate its resources to adjust its industrial structure to take advantage of its technological strength fully, but also favors the overall development of the energy bases.

The experts further pointed out that these five provinces have 47 percent of the coal resources in China, averaging 3460 tons of coal per capita, the most energy abundant area in China. In 1985, these areas produced 364 million tons

of coal, approximately 41.7 percent of all coal produced in China. The net amount of coal shipped was 153 million tons, which is 88.2 percent of all the coal transported in China. Today, the demand for coal to be shipped from these energy bases is rising rapidly. Shipping coal is of top priority for the energy bases. The policy to construct energy bases ought to be formulated based on resources and geological conditions. To transport a combination of commodities including coal, electricity and energy-intensive products to support the national economy in an optimized manner should be considered.

After more than 30 years of construction, although energy-intensive industries have been developed in these 5 provinces, some nationally known businesses have been built and some large projects are being constructed, they only represent a small portion of the industry in China. A disproportionately high amount of energy-intensive products are being manufactured in the eastern part of the Northeast and in the Southeast where energy is in short supply. This arrangement needs to be adjusted. As coal is being shipped from these 5 provinces, certain energy-intensive products are being supplied form outside the region. The shortage of steel, caustic soda, and soda ash is even worse than the average in China. It requires the unnecessary transport of materials back and forth which wastes a great deal of capacity. As an example, in 1985, these energy bases ordered over 300 million tons of energy-intensive products. To produce these products, the region shipped nearly 10 million tons of coal, which is equivalent to 2 percent of the railroad coal transport capacity in China. It is about 5 percent of the coal shipped out of the region.

12553/12232

POWER OUTPUT UP NEARLY 10 PERCENT IN 1987

40100006 Beijing XINHUA in English 0854 GMT 31 Dec 87

[Excerpts] Beijing, 31 Dec (XINHUA)--China has generated 493 billion kWh of electricity in 1987, an increase of 9.7 percent over 1986, the Chinese Ministry of Water Resources and Electric Power announced here today.

China now has a total generating capacity of 101.95 million kilowatts, of which 8.1 million kilowatts were added this year, the highest in recent years.

The production of the Gezhouba and Longyang Gorge hydroelectric power stations has put China among the world's top electricity producers by adding a total installed capacity of 100 million kilowatts.

This year, the country generated 43.4 billion kWh more than the yearly plan.

China used various methods to collect funds for the power industry in 1987. Statistics show that by today, the country had issued 2.63 billion yuan worth of electricity bonds and the local governments had collected 2.5 billion yuan worth of investment funds.

But an official from the Ministry of Water Resources and Electric Power pointed out that China's electric power industry still faces a shortage of funds and the power supply cannot meet the country's needs. In 1987 the gap between supply and demand reached 60 to 70 billion kWh.

He said that in 1988 China will generate 525 billion kWh of electricity and see an increase of 8.25 million kilowatts in its installed capacity.

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CHINA NOTES IMPROVEMENTS IN NATIONAL POWER GRID

40130010b Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 2 Sep 87 p 1

[Text] Electric power construction is a strategic point in China's economic development, and in the past few years we have achieved a growth that economists have labeled "breakthrough."

Materials made available today by the Ministry of Water Resources and Electric Power show that 2,758 generating power stations of 500 kW or more were built in China from 1979 through June of 1987, which is 386 more than the total built in China over the last 29 years; total generated power during this period was 3.043926 trillion volts, which was 2.25 times the total amount generated over the past 29 years.

Even so, because of abrupt growth in recent years of all professions and industries, the power shortage throughout the country is still quite serious. At present, there is an annual shortage of about 70 billion volts.

China has come to be composed of a trans-provincial large power grid with the four areas that are the north, the northeast, the east, and the central area each having an installed capacity of more than 12 million kW. The number of power generating plants with installed capacities of 1 million kW has grown from three in 1978 to eleven.

Ministry officials believe that the formation of this great power network, these great power plants, and these great generating installations indicate that the Chinese electric power industry has entered a new stage of development.

Over the past 8 years, a total of 65.642 billion yuan has been invested in electric power construction, which is 2.46 times that of the total over the previous 29 years; within that sum was 2.415 billion yuan worth of foreign exchange, the local investment being 4.141 billion yuan.

12586

NATION NOW CREDITED WITH MORE THAN 100 MILLION KW IN INSTALLED CAPACITY

40130029 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 8 Dec 87 p 1

[Text] Beijing, 7 December--In a news conference called by the Ministry of Water Resources and Electric Power here today, Minster Qian Zhengying happily announced that as of 4 December, the 320,000-kilowatt No 2 generator of the Longyangxia hydroelectric power station became operational. China now has more than 100 million kilowatts in installed power-generating equipment--a new milestone in the history of China's electric power industry.

Qian Zhengying stated that this year [1987], China would put into operation power-generating equipment with a total installed capacity of more than 7 million kilowatts and it is projected that by the end of the year the nation will generate up to 490 billion kilowatt-hours of electricity.

The reason for the tremendous achievements in the country's electric power construction is the high level of attention given it by the Central Committee and the State Council. Since 1981, funds poured into the electric power industry have increased each year, especially in the last 3 years, when the amount of investment increased sharply to counteract the severe power shortages. This year, the total national investment in the industry was two and one-half times that invested in 1981. During the Seventh 5-Year Plan, the state could invest up to 14 billion yuan in this sector. The use of foreign investments in power has grown more rapidly. In the last 3 years, electric power departments have used loans from the World Bank, friendly nations, and other channels to accelerate electric power construction in China. Today, agreements have already been reached for the sum of U.S. 3 billion dollars. Capital construction reforms have been implemented focusing on the bidding process; these have been popularized universally for hydropower construction and partially for thermal power construction.

Qian Zhengying considers the achieving of 100 million kilowatts in installed capacity a new starting point. She stresses that the power shortage continues to be severe in China and in the future the nation should "invest more, install more, generate more, and use it efficiently."

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OFFICIALS SEE EASING OF GUANGDONG POWER SHORTAGE

40130010a Beijing RENMIN RIBAO in Chinese 19 Sep 87 p 2

[Article by Liu Xieyang [0491 3610 7122]: "Crisis Situation for Guangdong Electricity Shortage Begins to Ease"]

[Text] Breaking with the rule that the Electric Power Department is the sole supplier of electricity, Guangdong Province has made the most of enthusiasm for the local supply of electricity, and by adopting a variety of channels through which to raise funds, electricity is being supplied at various levels and through varied means by various organizations. This has begun to alleviate the serious shortage of electricity that has been the case in Guangdong.

Guangdong is the region that was first to implement open-door policies. Bordering on Hong Kong and Macao, the economy here prospered. Of the four special economic zones throughout China, three are here. The strip that is the Zhu Chiang Delta and that is made up of Shenzhen, Zhuhai, Shantou, and Furao is an important area for the economic development of the entire province.

For a long time now, because electricity supply in this area was managed only by the Electric Power Department, all funding was dependent upon allocation by the state. This was too centralized and was managed too closely with the result that the construction and development of electric power was slow, which created a serious shortage of electricity for both production and everyday life. During the period of the Sixth 5-Year Plan, only some 900 million yuan was spent on electric power throughout the province, an average annual expenditure of less than 200 million yuan. The installed capacity of medium and large-scale power stations (plants) in operation was only 325,000 kW, and average annual generation capacity grew only by 9.13 percent, which was a long way from being able to meet the needs of the rapid economic development in this area. Due to insufficient electric power, industrial plants is some major cities only had electricity for 3 days a week, and in smaller cities and towns and in the countryside, electricity could only be supplied for 1 or 2 days each week. This led to the current situation in which production capacity cannot be fully exploited and where newly established factories cannot be put into production, which has seriously affected the development of industrial and agricultural production in this area. According to statistics from relevant

departments, the annual reduction in output value due to the lack of electric power is more than 10 billion yuan. Supply of electricity to the residents and businesses of some areas cannot be guaranteed. During 1986, there were 7,463 instances of power failures in Guangdong power grid, which accounted for a total reduction in power load of 21.739 million kW. Both factories and citizens have complained extensively about this. When foreign businesses hear that there is a serious power shortage, they are unwilling to invest in the running of factories in Guangdong.

To change this situation, beginning in 1984 Guangdong Province managed to break away from the exclusive control of the Electric Power Department so that at the same time as they were depending upon the state to manage electric power, they motivated the populace, invested their own funds, and brought about the generation of power by multiple sources.

They raised money by such diverse methods as borrowing from the state, encouraging localities and departments to pool resources, and issuing bonds for electric power construction. To ensure stable and reliable funding sources for electric power construction, the provincial government has decided to implement an exemption for taxes on products that are linked to the provision of electricity, for income taxes, and for regulatory taxes for all enterprises directly affiliated with the provincial Electric Power Bureau. The total sums of these tax payments will be for use exclusively in electric power construction. At the same time, there will be an additional fee for electric power construction assessed to subscribers to the provincial power grid, which will enable electric power enterprises to have a true capacity for self accumulation, for self transformation, and for self development, and which will bring about the fostering of electricity by existing electricity. With these two measures alone, more than 600 million yuan will be raised for electric power funding, more than three times that allocated by the state.

They motivated prefectures, municipalities, counties, and various departments to manage electricity at various levels. Currently, four large or medium power plants have been established in the province, having an installed capacity of 1.368 million kW. Large or medium size power plants have been constructed in Shenzhen, Guangzhou, Shantou, and Hainan Island, which have an installed capacity of more than 900,000 kW. Small hydroelectric or fossil fuel generators are springing up in each county.

They are managing electricity through various means. The state is doing so, the localities are doing so, there are joint operations between the central authorities and the localities, localities are joining with each other, and they may also attract foreign investment for such operations. The Huangpu coal conversion project with an installed capacity of 600,000 kW is an example of a joint operation between the central authorities and a locality. The Shajiao B Power Plant is a joint operation by the city of Shenzhen and a foreign business using foreign funds. Guangdong Province is starting a power plant with the city of Foshan and the prefectures of Zhaoqing, Shaoguan, and Meixian, for which current exploration, design, and

land requisition are nearly complete.

Because of the diverse channels for raising money and the multitude of organizations generating electricity at various levels and through various means, electric power construction has developed rapidly in Guangdong Province in recent years. For this year alone, the installed capacity for medium to large power plants that will go into production could reach 1 million kW, which would be more than three times that of the total capacity put into production during the 5 years of the Sixth 5-Year Plan. It is estimated that generation volumes this year will reach more than 22 billion volts, 4.5 billion volts greater than that for 1985, which will bring about an initial alleviation of the critical situation regarding electric power throughout the province. The utilization of capacity in some factories is progressively improving. Major enterprises such as the Guangzhou Nitrogenous Fertilizer Plant, the Guangzhou Iron and Steel Mill, and the Guangzhou Cement Plant can now make full use of their capacity, and the pace of industrial growth throughout the province will be greater this year than ever before in history. There has also been a great improvement for commercial and city resident use of electricity, and there are no longer the headaches caused by regular power interruptions. After many foreign commercial interests had seen the great improvement in the power situation, they once again came in large numbers to discuss business ventures. They are actively investing in plant operations, and it is estimated that the amount of foreign exchange generated this year will be more than 20 percent greater than that for last year.

Recently, this reporter interviewed a comrade in charge of the Guangdong Provincial Department of Electric Power. He said that the critical situation in Guangdong regarding electric power is currently easing, and that this has been a consequence of the restructuring. But this is only the beginning and we must continue along these lines. We are prepared to take another 5 years during which we will strive to bring the installed capacity of the entire province to more than 8 million kW, so that by 1992 the problems in the province concerning a short supply of electricity will be fundamentally resolved. Naturally, in this regard we must ourselves make ardent efforts, for at the same time it is even more necessary for us to have the strong support of the central authorities and of all areas.

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BRIEFS

POWER OUTPUT UPDATE--Beijing, 17 December--As of today, China's electric power output stands at 471.2 billion kilowatt-hours, meeting the year's target of 470 billion kWh 15 days ahead of schedule; this represents an increase of 45.29 billion kilowatt-hours over the comparable period of 1986 (a growth of 10.6 percent). Hydropower actually completed the year's target on 9 December and by the 16th had already produced 94.66 billion kilowatt-hours for an increase of 101.8 percent, or 4.91 billion kilowatt-hours, over 1986. This represents a rate of growth of 5.5 percent. Thermal power generated 376.56 billion kilowatt-hours of electricity, 99.9 percent of the year's plan, an increase of 40.38 billion kWh over the same period of 1986, or a growth rate of 12 percent. [Text] [40120025 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 18 Dec 87 p 11] /12232

500KV SUBSTATION NEAR COMPLETION--Beijing, 28 December (XINHUA)--A 500,000-volt substation, the largest in Asia, will soon be operational in Shanghai, the overseas edition of the PEOPLE'S DAILY reported today. The station will be completed in 1988. But, with the first phase work already completed, it will go into partial operation soon to increase the incoming power supply of Shanghai the paper said. The 450-million-yuan project is also one of the six largest of its kind in the world. It will incorporate the east and central China power grids. [Excerpts] [40100008 Beijing XINHUA in English 0234 GMT 28 Dec 87] /12232

NATION TO BUILD SEVEN STATIONS OF OVER 1000MW CAPACITY

40130041 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 21 Jan 88 p 8

[Excerpts During the Sixth 5-Year Plan, a dozen or so big hydropower projects, including Gezhouba, Dongjiang, Shaxikou, and others, were built under accelerated construction programs. Last year, the total installed capacity came to more than 850,000 kilowatts; this year the installed capacity will reach an all-time high: close to 1.8 million kilowatts. In the first 2 years of the Seventh 5-Year Plan, the state planned to begin construction work on Shuikou, Manwan, Ertan, Wuqiangxi, Geheyan, Lijiaxia, and Tianshengqiao First Cascade, all with capacities of more than 1000MW. The total installed capacity amounts to 11 million kilowatts. Among these hydropower stations, Manwan's installed capacity actually exceeds that of Gezhouba, making the former the national "champion" in terms of dam height and capacity.

Name of Dam	Construction site and river system	Installed Capacity (10,000kW)	Annual output (100 million kWh)	Dam maximum/height (meters)	Reservoir capacity (100 million M^3)
Shuikou	Min Jiang, Fujian	140	49.5	101	23.4
Wuqiangxi	Yuan Shui, Hunan	120	53.7	85.5	42
Manwan	Lancang Jiang Yunnan	125	54.8	124	9.2
Ertan	Yalong Jiang Sichuan	300	162	240	58
Lijiaxia	Huang He, Qinghai	160-200	59	165	16.5
Tianshengqiao 1st cascade	Nanpan Jiang Guizhou border	120	52.4	180	85.5
Geheyan	Qing Jiang Hubei	120	30.4	151	34

/12232

LANCANG BLOCKED AS WORK GOES AHEAD ON MANWAN

OW201336 Beijing XINHUA in English 1240 GMT 20 Dec 87

[Text] Kunming, 20 December (XINHUA)--The torrential Lancang river was cut off at Manwan in Yunnan Province today as a dam was completed for building a major power station.

With a designed capacity of 1.5 million kW, the Manwan station will be the second largest of its kind in China, next only to the Gezhouba station on the [Chang Jiang].

A key state project for the Seventh 5-Year Plan period (1986-1990), the station is expected to help add an industrial and agricultural output value of 16.8 billion yuan (4.54 billion U.S. dollars) annually after completion.

The station is a joint undertaking by the Ministry of Water Resources and Electric Power and the Yunnan Provincial Government with an investment of more than 1 billion yuan (270 million U.S. dollars).

Tenders were invited for different parts of the project.

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CSO: 40100004

BRIEFS

TAIPINGWAN NO. 4 UNIT OPERATIONAL--On 15 November, the 47,500-kilowatt No. 4 generator of the Taipingwan hydroelectric power station, a joint Sino-Korean construction project, officially went into operation. This marks the completion of work on this large-scale hydropower station on the Yalu Jiang. The station has a total installed capacity of 190,000 kilowatts for a yearly power output of 770 million kilowatt-hours. The station's No.4 generator will transmit electricity to both China and Korea. [Text] [Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 24 Nov 87 p 3] /9738

CSO: 40130030

BRIEFS

ZHEJIANG 2400 MW PLANT--Hangzhou, 6 Jan (XINHUA)--Construction of the Beilungang Power Plant, one of China's biggest thermal power plants, officially started on 5 January. The power plant, to be built on the southern shore of Beilun Harbor, is designed to have a capacity of 2.4 million kilowatts. The first phase of the project consists of two 600,000-kilowatt, coal-powered generating units, a 500,000-volt transformer station, a 35,000-ton coal pier, and a fresh water reservoir, costing about 2 billion yuan in investment. The two generating units are scheduled to go into operation in 1990 and 1991 respectively. [Summary] [40130027 Beijing XINHUA Domestic Service in Chinese 1628 GMT 6 Jan 88] /6662

250MW PLANT FOR HAINAN--According to JIEFANG RIBAO, the Shanghai Corporation for Economic and Technical Cooperation with Foreign Countries and the Shanghai Company to Contract Electrical Engineering Projects have been contracted to design, build, and install two 125,000-kilowatt generators for Haikou Power Plant on Hainan, the largest project invested by the Hong Kong-Macao International Investment Company, Ltd. in Hong Kong. The project, the largest ever undertaken by Shanghai's electrical and mechanical engineering industry,m is also the largest by the Shanghai Company to Contract Electrical Engineering Projects. A ceremony to sign the contract was held at Jinjiang Hotel on 3 January. [40130037 Shanghai City Service in Mandarin 2300 GMT 3 Jan 88 OW] /6662

WORK BEGUN ON BINHAI--Work has now begun on the Binhai thermal power plant in Binyang City, the biggest such capital construction project under way in China today in terms of size and investment. The Binhai thermal power plant has a design installed capacity of 425,000 kilowatts and includes the main power-house project, a coal transport (conveying) system, an ash removal system, a water supply system, etc. The plant is scheduled for completion in 1991. When completed, the Binhai thermal power plant will generate some 2.46 billion kilowatt-hours of electricity a year. [Text] [40130031 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 21 Nov 87 p 1] /9738

COAL MINISTER ON 1988 REFORM PROGRAM

40130040 Hong Kong LIAOWANG OVERSEAS EDITION in Chinese No 1, 4 Jan 88 p 7

[Article by Yu Hongen, Minister of Coal Industry]

[Text] We have made some achievements in the reform of the coal industry in recent years. The national coal output was 789 millions ton in 1984 and exceeded 900 million tons in 1987. There have also been some improvements in the varieties of coal products. The long-standing situation of supply falling short of demand in coal has been changed and the shortage of coal has been improved for 3 years in succession.

In 1988 and the next few years, we must use reform to guide the overall situation and promote all work in the coal industry. The main tasks for economic structural reform in the coal industry are: To give more decisionmaking power to enterprises, to improve the operational mechanism of enterprises, and to fulfil the general contracting task around the central link of invigorating enterprises in accordance with the requirement of separating the ownership from the right of management. As for the contracting task in the next 3 years, we will assign a contracting task to each enterprise and each mine or factory inside an enterprise and clearly institute the contracted management responsibility system of the management group headed by managers. Inside an enterprise, we will actively develop various kinds of contracted and leased management and introduce into some small mines and factories inside state-run coal industry enterprise a series of management methods that have proved effective in collective-run enterprises. We must also introduce the competitive mechanism into enterprises and the contracted management of mines and factories inside enterprises. Those who gain recognition as managers through competitions should be appointed bureau, mine, or plant directors and have the right to manage production and get rewards and run corresponding risks in accordance with the management of the enterprises as stipulated in the contracts. Meanwhile, we will further improve the leadership system of enterprises, and institute the contracted management system, the manager responsibility system, the target responsibility system within the manager's tenure of office, and the auditing system at the expiration of the manager's tenure of office in a combined way. In addition, we must use the experience of the Northeast and Nei Mongol coal Industry Joint Company for reference, set up coal enterprise groups involving different areas, and actively develop horizontal ties between enterprises.

While continuing to conduct reform and open up to the outside world, we must strengthen trade management of local coal mines, and collective-run town and township coal mines in particular; consolidate and transform the coal mines; and guide them to gradually move to normal production, so as to strengthen their reserve strength for future development and their ability to resist disasters. We must properly build a number of key coal-producing counties that have been planned, and do our best to maintain stable and healthy development of local coal mines.

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STATUS, FUTURE OF COAL INDUSTRY REVIEWED

40130027B Beijing GUANGMING RIBAO in Chinese 28 Oct 87 p 2

[Article by Xu Ying [1776 4481] and Deng Haiyun [6772 3189 0061]: "Reform and Opening to the Outside World Have Brought About Momentous Changes in Coal Industry Development--Interview with Minister of Coal Industry, Yu Hongen [0060 3163 1869]"]

[Text] The coal industry, one of the lifelines of the country's economy, has undergone momentous changes during the past 8 years. A few days ago, this correspondent interviewed Minister of Coal Industry Yu Hongen on the achievements in the nation's coal industry.

Building of the Antaibao Coal Mine Provides a Model for Investment in China by Foreign Entrepreneurs

Minister Yu Hongen had just returned from accompanying Armand Hammer, chairman of the board of Occidental Petroleum Company, who had taken part in ceremonies marking the beginning of production by the Antaibao coal mine at Pingshuo. He said that the Antaibao mine is one of the largest open-pit mines in the world today, with an annual output of more than 15 million tons of raw coal and requiring a total of between 1,400 to 1,700 personnel. The construction of this mine has a significance that extends far beyond the coal industry itself. It demonstrates the success of the country's policies of reform and opening to the outside world, and it provides a model for investment in China by foreign entrepreneurs. Minister Yu said that equipment and technology at the Pingshuo mine are first-rate internationally. It took only 26 months from the signing of the agreement between China and the United states to completion of construction. Such a speed of construction is also a rarity in the world. It marks a great step forward in the country's coal extraction technology. In order to adapt to and master this large, modern enterprise, we have produced a group of managerial and technical personnel ranging from managers to technicians through instruction, fact finding tours abroad, and on-the-job training. They have substantially mastered this body of advanced managerial methods, earning praise from the American experts.

Nationwide Complete Contracting of State-Controlled Coal Mines Is a Major Reform

Just a few years of development has increased coal output, from 600 million tons to today's 900 million tons a year in a leap to second place in the world for substantial solution to the country's "energy starvation." Coal is also a major foreign exchange export for the country, with more than 16 million tons being exported this year to more than 20 countries and regions. How did

this heartening change come about? Minister Yu said these achievements have been the result of reform. In order to improve the level of administration and management in the coal industry and promote development of the coal industry, 2 years ago the Ministry of Coal instituted a major reform of complete contracting inputs and outputs at all state controlled coal mines. This is a fine form of responsibility system for contracting operations that is characteristic in the coal industry. More than 2 years of practice have shown this reform to be successful. It embodies the principle of a proper separation between ownership and operating rights, and it improves the enterprise operating mechanism in keeping with the main thrust of pervasive enterprise reform. During the first 2 years of contracting, the output of state-controlled coal mines increased nearly 20 million tons, the number of production personnel was reduced by 260,000, and the efficiency of all personnel rose 10.9 percent. Contracting has spurred enterprises' efforts to change from the production type to the production management type for the general strengthening of administration and management, promotion of the development of diversification, and increased economic results and competitiveness. Following contracting, enterprises have planning rights, rights in the use of funds, rights regarding internal distribution of materials procurement rights, and cadre management rights, which have made things more lively than formerly. Under guidance of reform and opening to the outside world, coal pits throughout the country are making a transition to modernization, group after group. It is anticipated that the end of the present century, state controlled mines will reach the current level of mines in developed countries.

Science and Technology and Skilled Personnel for Vigorous Development of the Coal Industry

Experiences in complete contracting in state-controlled coal mines have pioneered a new road for economic contracting responsibility systems in state owned enterprises. It was improvement in the quality of the management cadre ranks in coal mines that played a key role in this reform. Attention to investment in intellect is a fine tradition in the Ministry of coal industry, which has explicitly proposed use of skilled personnel and science and technology to promote steady development of the coal industry.

In talking about this point, Minister Yu said that our future goal is to increase output without increasing manpower. Use of advanced technology and equipment, and management systems to realize the goal of increased output will require sufficient skilled personnel. During the last several years, the Ministry of coal industry has consistently placed on the ministry and party daily agendas of important things to do the development of education to improve scientific and technical skills.

The Ministry of Coal Industry was said to have invested more than 80 million yuan in education each year during the Sixth 5-Year Plan, and it will increase this amount to 120 million yuan during the Seventh 5-Year Plan. The Beijing Academy for Coal Management Cadres is the first State Council approved cadre management academy in the country. Additionally, the Ministry of Coal Industry has set up coal management cadre academies in Zhangzhou, Chengdu,

Changchun, and in Shanxi Province. More than 3,500 coal mine management and technical cadres have been trained in these academies. More than 90 percent of those now holding leading positions in industrial plants and mines have a secondary technical school or university education. From 1982 through 1987, the coal system trained a total of 29,000 college undergraduates, 820 graduate students, and more than 50,000 secondary school specialists. By operating joint schools, it was able to train more than 800 people in the fields of teaching, medicine and environmental engineering, all of whom are in short supply in coal mining, transfusing large amount of fresh blood into China's "coal colossus." Remarkable achievements have also been scored in coal research. The coal industry has had more than 1,000 scientific and technical achievements evaluated since 1981, 43 of them being awarded national science and technology progress awards, and six being awarded national invention awards.

Minister Yu Hongen concluded by saying that coal is China's most important energy source today, accounting for more than 75 percent of the country non-renewable energy sources. According to national forecasts for economic development, 1.4 billion tons of coal will be needed by the end of the present century. Realization of this goal will require the country to rely on scientific and technical progress, the training of large numbers of skilled personnel, and active modernization of the coal industry.

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1987 PRODUCTION COULD TOP 900 MILLION TONS

40130024 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 3 Dec 87 p 1

[Excerpt] Yu Hongen, minister of the Ministry of Coal Industry, said today that China's total coal output for 1987 could hit 902 million tons.

At a national working conference on coal, Yu stated that as of November 1987, China's estimated raw coal production stood at 843 million tons, or 91 percent of the year's plan. According to Yu, raw coal output by November was 37.25 million tons more than the comparable period in 1986, for a growth of 4.86 percent.

When speaking of the progress being made by the coal industry, Yu Hongen commented that by the end of the year some 25 new and renovated or expanded coal mines would be in production. These mines will have a total yearly capacity of 24.27 million tons, the most for any single year for the past 17 years.

The amount of coal exported will also set a new record. Yu said that according to projections, exports for 1987 could reach 13.5 million to 14 million tons for earnings of U.S. 450 million to U.S. 470 million dollars. At the same time, China wants to export coal machinery to the United States, the Federal Republic of Germany, and other countries so that China can become an exporter rather than an importer of such equipment.

When touching on the subject of the production and reform of China's coal industry, the minister stated that the major planning guidelines for 1988 were:

1) A coal production capacity of 930 million tons;

2) a coal dressing capacity of 62.6 million tons; and

3) the construction of some 124 mines with an annual aggregate capacity of 141.79 million tons, of which 28 mines would be able to produce 28.34 tons.

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STATUS, FUTURE DEVELOPMENT OF STRIP MINING IN CHINA DISCUSSED

40130083 Beijing SHIJIE MEITAN JISHU [WORLD COAL TECHNOLOGY] in Chinese No 6, Jun 87 pp 1-5

[Article by Engineer Zhang Min'ai [1728 2404 8302] of the Science and Technology Information Institute, Ministry of Coal Industry: "Changes in Open-Pit Mining in China During the Sixth 5-Year Plan and Future Development"]

[Text] China's coal industry made substantial achievements during the Sixth 5-Year Plan. Total output of raw coal was 872 million tons in 1985, up 252 million tons from 1980. This was the largest output increase since China was founded. China surpassed the Soviet Union in raw coal output in 1984 and is second only to the United States worldwide. Mechanization reached 44.9 percent in unified distribution coal mines in 1985, with 22.46 percent via comprehensive extraction. These figures were 7.92 percent and 9.36 percent higher, respectively, than in 1980. The extent of mechanization in tunneling was 45.82 percent, up 8.33 percent from 1980.

Shaft mining continued to dominate coal industry production in China during the Sixth 5-Year Plan. The proportion from strip mining remains less than 3 percent. This figure was less than 5 percent in unified distribution coal mines. The graph below shows the changing proportions of shaft and strip mining in unified distribution coal mines since China was founded.

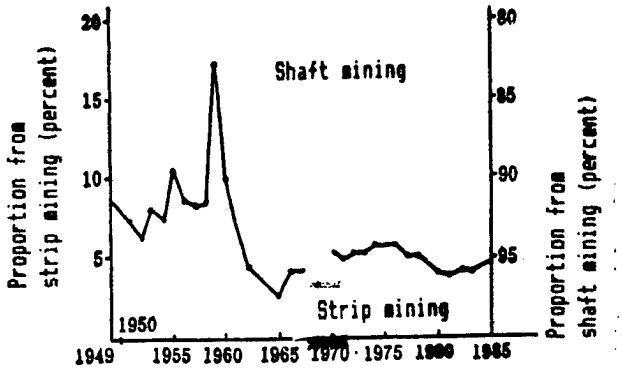

Figure. Relative Proportions for Shaft and Strip Mining.

The proportion from strip mining has not increased, but output from strip mining has risen gradually, up 51 percent between 1980 and 1985. More important is that changes have occurred and gratifying progress has been made in extraction techniques, equipment standards, technology, construction capital sources, development patterns, management, and so on.

I. The Sixth 5-Year Plan Was the Period of the Largest Scale and Strip Mine Construction Since China Was Founded

The scale of new construction and rebuilding at strip mines during the Sixth 5-Year Plan was about 15 million tons. This figure includes 11 million tons/year in newly-built scale. The main contributors were the Huolin He South Strip Mine with 3 million tons/year, the Yimin He No 1 Strip Mine with 1 million tons/year, the Pingshuo Antaibao Strip Mine with 7 million tons/year (a Chinese-American joint venture with a total scale of 15.33 million tons/year), and the three newly-developed mining regions at Huolin He and Yimin He in Nei Monggol and Pingshuo in Shanxi. The scale of transformed and expanded construction was about 4.1 million tons/year. They included the Fushun West Strip Mine, the (Zhalainuoer) Lingquan strip Mine, Xiaolongtan's Buzhaobei Strip Mine, and the Yilan Strip Mine. The Huolin He South Strip Mine and the Yimin He Strip Mine began producing in September and October 1984, respectively, and the transformation and construction project at the Lingquan Strip Mine was completed in 1983. The others are under construction or undergoing transformation and expansion. The scale of strip mine construction is equivalent to that during the First and Fifth 5-Year Plans combined. After all of the scale listed above goes into production, output from strip mines will be more than 50 percent higher than it is now.

II. Obvious Changes Occurred in Strip Mine Extraction Technologies During the Sixth 5-Year Plan

China has about 18 or 20 strip mines before 1980. About 73 percent of their output was shipped on standard gauge railroads. Electric locomotives hauled 38 percent and steam locomotives 35 percent. About 18 percent was shipped on narrow gauge railroads. Trucks hauled about 9 percent. It is apparent that railroad transport accounted for about 91 percent and that railway shipping has an absolute advantage in China's strip mining.

Under guidance by the principle of deregulation and reform, technical exchanges were established with foreign countries during the Sixth 5-Year Plan. They transformed strip mine extraction technologies in China: Strip mines with suitable conditions began using continuous extraction technologies involving rotary bucket excavators, conveyors, and earthmovers; semi-continuous technologies involving mechanical digging and loading, work face truck transport and conveyor transport and lifting; comprehensive extraction technologies involving integrated truck hauling, conveyor transport, and railway transport, and other patterns, within the pits; and expanded use of truck extraction technologies.

China now has about 30 large and small-scale strip mines. Calculated according to output and design capacity, about 43 percent was shipped on standard gauge railroads. Electric locomotives hauled 27 percent and steam

locomotives shipped 16 percent. About 2 percent was shipped on narrow gauge railroads. Trucks hauled about 36 percent. Comprehensive extraction technologies were used for about 18 percent and continuous extraction technologies for about 1 percent. Compared with the later part of the Fifth 5-Year Plan, railway shipping technologies declined from 91 percent to 45 percent and truck transport increased from 9 percent to 36 percent. New comprehensive extraction and continuous extraction techniques were added. Comprehensive extraction techniques refer to the Xiaolongtan Strip Mine and the Fushun West Strip Mine. Two new Chinese-new continuous technique systems involving small bucket excavators, conveyor and earthmover system. Although these two generations of bucket continuous extraction equipment are small by foreign standards, are equivalent to levels during the 1930's and 1940's, and have begun to experience some problems, they depended on China's own efforts to begin using continuous extraction technologies in China.

One can see from the above that rather substantial changes occurred in strip mine extraction techniques during the Sixth 5-Year Plan. The proportion of railway shipping techniques has declined and the proportion of truck transport has risen. Utilization of bucket continuous techniques and comprehensive techniques has begun. These changes are suited to the trends of development in strip mining technologies in the world today.

III. Starting Equipment Innovation, Higher Standards for Technical Equipment

Almost 80 percent of the output in China's strip mines is hard coal and 20 percent is brown coal, so rock drilling and blasting is required foremost of the coal.

Before 1980, nearly all of the drilling equipment was outdated percussion drills that involved a lot of physical labor, had low efficiency and were complex to operate. Most of the digging and equipment was traditional mechanical shovels (electric shovels) with a bucket capacity of less than $4m^3$. Transport equipment mainly involved steam locomotives, which had low efficiency (they were abandoned long ago in foreign strip mines). Only three mines used standard gauge electric locomotives, with carrying capacities of 80 tons and 150 tons. A few small mines used truck transport with carrying capacities of 27 tons or less. Overall, equipment levels were backward.

During the Sixth 5-Year Plan, all producing strip mines carried out equipment renovations and gradually began using deep-hole drills and gear wheel drills instead of percussion drills. Most of the percussion drills at the Fushun West Strip, for example have been replaced with rotary drills and deep-hole drills. The Hegangling North Strip mine, the Pingzhuang West strip Mine, the Haizhou Strip Mine, and other have added deep-hole drills and gear wheel drills. All of the newly-constructed strip mines are using gear wheel drills which are in common use throughout the world. The Huolin He and Pingshuo Antaibao Mines, for example, use GD-25C, DM-H and DM-25 gear wheel drill rigs manufactured in the United States. Strip mines at present mainly use deep-hole drills and gear wheel drills.

Substantial changes were made in extraction and loading equipment during the Sixth 5-Year Plan. Medium and large-scale mechanical shovels and hydraulic shovels at advanced world levels came into use. The Pingshuo Antaibao Strip Mine, for example, uses a P&H 2800XP mechanical shovel made in the United States with a bucket capacity of 24m³ for stripping and a West German H241 hydraulic shovel with a bucket capacity of 15m³ for extracting the coal (they were used for stripping during construction). The Huolin He South Strip Mine uses West German RH75 hydraulic shovels with a bucket capacity of 8.1m³ for stripping. The Fushun West Strip Mine is using Chinese-made WD-1200 mechanical shovels with a bucket capacity of 10m³. The Xialongtan Strip Mine has been using two Chinese-made small-scale rotary bucket excavators for stripping which have a theoretical production capacity of 400 to 70m³ per hour (loose) and a linear cutting force of 100kgf/cm. The machines weigh 164 tons and can excavate at an upper height of 10m. The design for the Buzhaobei Strip Mine stipulates the use of three Chinese-made medium-scale rotary bucket excavators for coal extraction and stripping. They have a theoretical production capacity of 1,500 to 2,000m³ (loose) per hour, and can excavate at an upper height of 15 meters. The combined bench height is 40m and they have a linear cutting force of 120kgf/cm. The machines weigh 500 tons. One unit has been manufactured and now is undergoing industrial testing.

There also were obvious changes in transport equipment used in strip mines during the Sixth 5-Year Plan. The main change is the use of a 1,000mm-wide Chinese-made conveyor moving at 2.5m/s for hauling stripped material at the Xiaolongtan Strip Mine. The Buzhaobei Strip Mine uses a 1,200mm-wide, 4m/s Chinese-made conveyor to haul coal and stripped material. The Pingshuo Antaibao Strip Mine is using dump trucks made in the United States with a carrying capacity of 154 tons which are at advanced international levels. The Huolin He South Strip Mine is using 68 ton dump trucks made in the United States and Japan. The Pingzhuang West Strip Mine has replaced its steam locomotives with electric locomotives with a carrying capacity of 100 tons manufactured in the German Democratic Republic.

These changes in transport equipment have led to corresponding changes in earthmoving equipment. The Xiaolongtan and Buzhaobei Strip Mines, for example, are using earthmovers with a theoretical production capacity of 1,000m³ (loose) and 2,000m³ (loose) of earth per hour. The Pingshuo and Huolin He Strip Mines are using 450hp and 320hp earthmovers, respectively, for dumping.

Another characteristic of the Sixth 5-Year Plan is new attention to the role of various auxiliary equipment. All of the newly-built strip mines must be outfitted with front-loaders, earth spreaders, road graders, sprinklers and other auxiliary equipment. The existing producing mines also have added the required auxiliary equipment.

IV. Using Foreign Investments, Joint Investments To Develop Management

The coal industry actively used foreign investments to build mines during the Sixth 5-Year Plan. Foreign investment utilization took many forms. At the Pingshuo Antaibao Strip Mine, for example, a contractual joint investment venture with some foreign investments and some loans made within China was

employed, with bilateral joint investments, joint management, joint risk-taking and joint distribution of profits to attain the goal of supplementing shortages in domestic capital and insufficient technical equipment and to study and grasp modern mining management and administration experiences. The cooperative venture contract for this mine was signed jointly on 29 June 1985 by the China Island Creek Coal Co., Ltd., which is composed of the China Pingshuo No 1 Coal Co., Ltd. and the U.S. Occidental Petroleum Corp., and it has received Chinese government approval. Ground was broken on 1 July 1985, and the design capacity is 15.33 million tons/year. The associated coal washing plant is being built concurrently and will have an intake washing capacity of 15.33 million tons/year. There will be 11.95 million tons/year of commodity coal after washing. It has been predicted that this mine will complete the "development phase" and go into operation before 1 September 1987. At that time, it will have stripped about 60 million m^3, it will have extracted, dressed, and shipped out 494,000 tons of commodity coal, and the coal washing plant will be finished and turned over for inspection and acceptance.

Management and administration systems at this mine are not like those in China, and they also are somewhat different from those in other joint ventures. A "Joint Management Commission" will be the organ with the greatest authority in the joint venture and will have overall responsibility for policymaking regarding management and administration of the joint venture. The day-to-day operation of the joint venture mine is the responsibility of the general manager appointed by the commission, aided by an assistant general manager. It has nine subordinate departments which divide up management of each aspect of the strip mine. For the first 12 years after construction begins, the American partner will be responsible for the joint investment mine and the regular personnel in each of the departments, while the Chinese side will serve in assistant positions. The Chinese side will take primary responsibility after 12 years and the American counterparts will serve in assistant positions. The goal is to facilitate the study of advanced management and administration and technical management experiences. The hiring system at the mine will be different from other open-pit mines in China. Whether they are high-level personnel or workers, whether they are U.S. personnel or Chinese personnel, competent workers will be appointed, while incompetent workers will be dismissed by the general manager or assistant general manager.

V. Problems that Exist

1. Low labor productivity

Labor productivity in Chinese strip mines is 1.75 percent that in West Germany, 5 percent that in East Germany, 5.6 percent that in the United States, 6.7 percent that in the Soviet Union, 6.7 percent that in Australia, and 12.5 percent that in Czechoslovakia. Full-staff productivity at modern mines constructed in the past few years like the Wangzhuang coal mine and Shigejie coal mine now exceeds 3 tons/shift, which is higher than the average level in present open-pit extraction. Productivity in some strip mines is only 0.8 to 0.9 tons/shift, which is only equivalent to the level in normal

shaft mines. It is apparent that labor productivity in China's strip mines is not just low in world terms. It also is merely equivalent to mid-level standards in Chinese shaft mine extraction.

2. Economic results are low, especially at lignite strip mines

The investment per ton of coal in strip mines in the primary open-pit coal mining nations of the world generally is only about 50 to 70 percent that in shaft mines. The cost per ton of coal usually is about 50 percent higher than in shaft mines. The investment per ton of coal in some developing nations is usually higher than in shaftmines, while the cost per ton of coal is lower than in shaftmines. Open-pit extraction is used for almost all of the lignite resources in foreign countries, which shows that the economic results of strip mining are better than those in shaft mining. These countries mainly use their lignite to generate power and secondarily for making coal bricks, gasification, coking and so on. These provide economic as well as social benefits.

The investment per ton of coal in China's strip mines generally is higher than in common extraction shaft miners and are equivalent to or slightly higher than comprehensive extraction shaft mines. The cost per ton of coal for anthracite from strip mines is slightly lower than shaft mines. With the exception of those in Yunnan, most lignite strip mines operate at a loss, and the amount of the losses at some of the mines exceed the value of sales for various reasons. There are serious deficits in China's lignite strip mines and the economic results are very poor.

3. Output is low in open-pit extraction, resources are not being used quickly

China's coal reserves rank among the largest in the world, and we also are rich in economically-recoverable reserves suited to strip mining. Open-pit output is very low, however, only 5 percent that in the United States, 8.3 percent that in the Soviet Union and the German Democratic Republic, and 20 percent that in West Germany and Australia. Czechoslovakia's reserves which are suited to open-pit extraction are only 20 percent of China's, but output is three times greater than in China. India has much smaller reserves suited to open-pit extraction than does China, but strip mining has developed very quickly in recent years and open-pit output now is three times as much as in China.

Calculated at 1985 output, Czechoslovakia's strip mines have the highest output/reserve ratio at 2.5 percent. The German Democratic Republic is second, at 1.25 percent, and the figure is 0.34 percent for the United States, the Soviet Union, West Germany and Australia. China has a ratio of only 0.13 percent, which shows that useful resources are not being used quickly.

VI. Factors Affecting the Development of Open-Pit Extraction

Strip mining has developed slowly in China. There are both objective and subjective reasons for this.

(1) Coal fields suited to strip mining were proved rather late. With the exception of a detailed survey of reserves during the 1960's which suggested that the Pingshuo coal field was suited to open-pit extraction, proposals were not made until the middle 1970's for detailed surveys of reserves for other large coal fields like Baoshan, Huolin He, Yimin He, Zhaotong, Junggar, and other places. In these coal fields, however, poor quality, low thermal value lignite fields were proven before good quality, high thermal value bituminous coal fields. This affected the results of strip mine development. Huolin He and Yimin He, for example, preceded Junggar, Shenmu, Dongsheng and other coal fields, while detailed surveys are still under way in the Shenmu coal field, which has the best quality coal. Only sample surveys have been done in the Dongsheng coal field. Construction of the Pingshuo Strip Mine began in 1965 but stopped later, so an opportunity for development was bungled.

(2) Most coal fields are in remote geographical locations distant from industrial regions. Little of the coal is used locally and there is no urgent need for large-scale development. Mine construction first of all requires that railroads, highways, electricity and water supplies, communications,and living facilities be built. This requires considerable inputs of capital, and the investments per ton of coal are high. This is true of already-developed coal fields like Huolin He, Yimin He, Pingshuo, and others, as well as those to be developed like Junggar, Shenmu, Zhaotong and so on.

(3) Conditions in China's coal fields suited to strip mining generally are more complex than in other nations. One or two extraction techniques are not adequate for developing all types of coal fields, so a variety of extraction technologies must be adopted. Other primary coal producing nations, however, basically can use one or two types of technologies to develop their coal fields. The United States, West Germany,the German Democratic republic, and others are examples. Moreover, the depth of extraction in coal fields in China which can use single bucket--truck technologies is generally greater than in the United States. Added to the extremely high price of diesel fuel in China, the poor quality of truck parts, and high consumption (of things like tires), production costs inevitably will be higher. The lithology of coal fields where rotary bucket continuous technologies can be used is much harder than in West Germany, the German Democratic Republic, and other nations of East Europe. The resistance to linear cutting is usually in excess of 100 to 120 kgf/cm, which is near the boundary for adoption of this sort of technology. The cold winters (with air temperature below -25 degrees C) and the special measures that must be adopted for equipment manufacture, materials quality, maintenance, and extraction also affect the investments and costs per ton of coal. For this reason, most coal fields in China which have adopted techniques and equipment similar to those in foreign countries have economic results inferior to foreign countries. China still does not have any coal fields suited to the use of hanging bucket shovels with no transport to the pile and earthmoving bridges, and other extraction techniques with the best economic results.

(4) Modern technical equipment is a prerequisite for mechanized open-pit extraction. Forces within China are not strong and material technologies basically are low. Integrated manufacturing levels are low, and there are

few varieties and models of strip mining equipment. Much strip mining equipment is used for only special purposes and is greatly affected by the weather. Equipment of different models, specifications and materials quality is needed (tolerant to cold and heat). Manufacturing departments within China now are incapable of meeting these requirements, so equipment must be imported form foreign countries. This greatly increased the investments per ton of coal and production costs, which affect the economic results of strip mining.

(5) Because of policy errors during the 1960's, the laws of open-pit extraction were violated, as were capital construction procedures. Exploration, design and construction were done concurrently. Investments were compressed and startup was simplified. Output was set according to sales and changing users, and so on. This made it impossible for strip mines like the Pingzhuang West Strip Mine, the Hami Sandaoling Strip Mine and others to attain their design capacity for a long time after going into operation. Plans did not keep to schedule and things were rushed at the Huolin He and Yimin He sTrip MInes, the Many changes in scale, technologies, and in construction staffs as well as problems with management systems, coal quality and other things affected economic results.

(6) The scale of strip mines usually is larger than at shaft mines, so total investments with identical investments per ton of coal are larger. As a result, they are not easy construction projects to carry out, which has affected the development of strip mining.

VII. Proposals for Future Development

(1) New principles and system swill be adopted for development of the Shenmu and Junggar coal fields during the Seventh 5-Year Plan.

Shemu coal field will be managed through a shareholding system by the Shenmu Coal Field Development and Administration Corporation, an enterprise-type company with independent economic decisionmaking authority. Central and local departments, units and enterprises are eligible to become shareholders. The capital that is raised will be used mainly for road repair and for construction of a coal collection and shipping station, and a coal washing plant. The duty of the corporation is to assume responsibility for coal extraction plans. Technical training, and construction of public facilities, and for purchasing, shipping, and selling the coal.

A similar form will be adopted to develop Junggar. The Junggar coal industry Company will be established under the leadership of the Ministry of Coal Industry for unified construction of coal, power, and roads, and for overall management. Funds for construction will be provided mainly by Japanese Energy Loans, which will be used to build a strip mine with a design production capacity of 3 million tons/year, a pit-mouth power station, and a special railway line. There also will be a 3 million ton local coal mine (preparations underway in 1987). The Junggar Coal industry Company also will purchase coal from local mines for centralized washing and processing, and for unified shipment.

(2) The new 5 million tons/year Yuanbaoshan Strip Mine in Nei Monggol and the 1.5 million tons/year Tiechang Strip Mine in Xinjiang also will be built

during the Seventh 5-year Plan. The Huolin He Strip Mine will be expanded to a yearly production capacity of 7 million tons. In all, the scale of construction in Ministry of Coal Industry open-pit mines alone may reach 25.5 million tons during the Seventh 5-Year Plan. If all of the strip mines built during the Sixth 5-Year Plan go into operation during the Seventh 5-Year Plan, output from strip mines will increase by 50 percent over the Sixth 5-Year Plan. At that time, the proportion from open-pit extraction may reach 4 to 5 percent.

(3) If the coal from strip mines is to be supplied to power plants, construction of power plants must proceed apace, and bilateral supply and demand contracts must be signed to avoid the lack of coordination which has appeared in power plants which must wait for coal and coal mines which must for the completion of power plants.

(4) When the conditions exists, the intensity of developments in strip mining regions which are in operation should be expanded in a planned fashion to make the fullest use of existing equipment and public facilities, and to recover resources as quickly as possible.

(5) Within the short term, China's coal industry will continue to be dominated by shaft mining to assure stable growth in output. This means that it will be impossible to achieve breakthrough-type growth in the proportion of strip mine extraction during the short-term to attain output levels found in the primary coal strip mining nations of the world. It must be acknowledged, however, that open-pit extraction also has its advantages in China, so it is very important that the development of open-pit extraction be given its proper status and that the proportion from open pit extraction gradually be increased. The cost per ton of coal in most strip mines is less than the cost in shaft mines in the same mining region. This is even true of the Xinqiu Strip Mine, which is re-extracting waste coal. The cost per ton of coal during the peak stripping period at the Haizhou mine also was lower than in shaft mines, and it has the lowest costs of all the unified distribution coal mines in China. The cost per ton of coal at the Huolin He Strip Mine is the highest among all of China's strip mines, but there still are economic benefits if indices for joint administration of coal and power are considered. This is exactly the reason behind other countries' efforts to develop open-pit extraction.

(6) Study modern advanced experiences, improve management and administration standards, improve personnel quality, raise equipment completion rates. According to foreign statistics, the equipment productivity of poor quality operating personnel is only 58 percent that of good quality ones. The importance of better personnel quality for improved economic results is obvious.

(7) As strip mining develops and its temporal and spatial relationships change, attention should be given to new trends, new technologies, and new equipment in foreign countries for use in China. Examples include semi-continuous technologies, high-capacity, high-angle transporters, new types of coal extractors, hydraulic shovels and hydraulic drive devices, and so on.

12539/12232

SHANXI FIELD NOW SAID TO BE WORLD'S THIRD LARGEST

40130077 Beijing ZHONGGUO DIZHI [CHINA GEOLOGY] in Chinese No 6, 13 Jun 87 pp 21-22, 20

[Article by Chen Ping [7115 1627] of the Shanxi Province Bureau of Geology and Mineral Resources]

[Text] Energy resources, particularly coal resources, are the foundation of China's national economy. As Shanxi has superior conditions for development of coal, every effort should be made to ascertain its coal resource situation as quickly as possible. Building Shanxi into an energy resource base is an urgent task for the national economy.

The Shanxi Bureau of Geology and Mineral Resources has reinforced coal resource surveys in recent years, and it has accumulated some experience and lessons. The following understandings are the subject of this discussion:

I Strengthen Surveys of Coal Resource Prospects, Select Sites Well, Provide Good Counterpart Services

The Shanxi coal field covers an area of 61,829 km², the third largest of the world's seven biggest coal fields. Only the Appalachian fields in the United States and the Kuzbas in the Soviet Union are larger. Shanxi's coal seams are stable and thick with gentle inclines and rich reserves. Coal varieties are complete and the coal is of excellent quality. It is buried at shallow depths and the technical conditions of extraction are simple, so mine construction proceeds quickly. For this reason, the development of Shanxi coal can provide the best economic benefits of saving investments, providing results quickly, and low cost. However, there are rather substantial disparities in geological work and research in the six large coal-accumulating basins (Datong, Ningwu, Xishan, Qinshui, Huoxi, and Hedong). Less work has been done in the Hedong and Ningwu fields. Hedong accounts for over 32 percent of the coal-bearing area in Shanxi, but total proven reserves there account for only 14.2 percent of total proven reserves in Shanxi. Moreover, they are concentrated in the souther part of the Hedong coal field and work has not begun in most areas. As a result, the Hedong and Ningwu fields should be the focus of coal prospect surveys. In addition, eliminating poverty and creating greater prosperity require that geological work in these fields be speeded up.

1. Collect complete data, do comprehensive research. collect all available data on geology, exploratory drilling, geophysical prospecting, satellite

photographs, scientific research, and producing mine shafts and so on, and do comprehensive studies and mapping as well as the necessary field exploration to fill in geological maps.

2. Start with reality, select optimum prospecting programs. Select prospecting grids based on actual situation and adapt to local conditions to speed up coal field geological work. Based on our guiding ideology of the geological characteristics, degree of stability, and changes in coal quality for coal seams in the region, as well as comprehensive mineral exploration, a survey was carried out using a 3,000 m by 3,000 m grid during initial surveys of resources prospects in the Hedong field. After verification that there were no major changes in the stability and thickness of the main Nos. 8 and 13 coal seam positions, the grid for exploratory drilling projects was expanded to 6,000 m by 6,000 m. After a few years of work and practice, we felt that equally good results could be obtained on a grid of bout 10 km by 10 km in regions with no or very few useful associated minerals.

3. Unified deployment, clear-cut division of labor, counterpart services. We implemented a division of labor for geophysical exploration and scientific research work in the six large coal basins and five coal-producing areas under jurisdiction of the Shanxi Province Bureau of Geology and Mineral Resources, and carried out scientific research and data compilation by periods and groups according to the varying extent of work.

A great deal of data has been collected through more than 80,000 m of exploratory drilling in the Hedong and Ningwu fields in recent years. It has supplied valuable information for building the Shanxi energy, heavy industry, and chemical industry base area. This is particularly true of development, utilization, and rational deployments in the Hedong and Ningwu fields, and in selection of mines with reliable quality and stable coal seams (including some suited to open-pit extraction) for construction of the large Hebao power plant, there by meeting the demands of industrial construction.

II. Strengthen Comprehensive Research, Raise the Quality of Coal Field Prospecting

Geological surveying and prospecting work should emphasize "quality first." Good quality in all phases of geological work is essential for assuming smooth progress in mine construction. Otherwise, mistakes may be made in mine extraction. For this reason, work should be done on the following points:

1. Collect complete and accurate primary data, strength comprehensive research work. Start with comprehensive data organization and study the geological conditions of coal formation, paleogeography of coal facies and coal accumulation conditions. At the same time, we also should reinforce comparisons of coal petrography and coal quality. This requires better quality compilation of all types of original data, unified requirements, unified patters, and establishment of a strict inspection system. Do solid basic geological work for all links from drawing up designs to the completion of survey and prospecting work.

2. Make full use of multiple means and types combined for carrying out work. Work should make full use of exploratory drilling, regional geological surveys, aerial (and satellite) photo interpretation, as well as seismic, gravitational, electrical, and other means throughout the survey and prospecting work process to facilitate a comprehensive understanding of the distribution, depth of burial and spatial shape of coal seams. Seismic methods provide excellent results in this region. After numerical processing, they can show clearly the denuded surface of the middle Ordovician system and make fracture structures with drops of several tens of meters visible. In addition, coal field logging plays an important role in demarcating coal seams and studying comparative coal geology and lithology. Rather good results also were obtained using natural gamma curve method logging to locate bauxite ore seams. Application of these methods had led to obvious improvements in speed of geological work and the quality of geological data.

3. Raise exploratory drilling and logging standards. The quality of coal cores from exploratory drilling projects directly affect the quality of coal field surveys and prospecting, and they are the key to evaluating coal seams and coal quality. We strictly prohibited the use of dual-action, dual pipe coal drilling during exploratory drilling. While continuing to popularize various types of coal sampling devices, we also used semi-synthetic pipe for taking core samples to prevent core contamination and breakage. This is particularly true of preventing the contamination of the coal cores by mud and rock dust. Adequate consideration also was given to other man-made factors like whether or not the samples were taken at appropriate times, the presence or absence of leakage holes when breaking and processing the samples, and other links.

Coal field logging is an important measure in coal field geological survey and prospecting work. A grading system for logging data must be strictly implemented. After logging, geology, exploratory drilling and logging departments should do on-the-spot checking and acceptance. The causes should be determined for any that fail to meet specifications. If they cannot be saved, they should be discarded and taken again.

4. Reinforce sampling and testing work

All samples should be collected in a timely fashion in strict accordance with regulations and requirements, and they should be sent out as they are collected. There should be different collection requirements and testing methods for coal of different quality and different uses. The samples taken should be representative, and the accuracy, reliability, and timeliness of all test data should be guaranteed.

In summary, the concern of the leadership and efforts at all levels in the shanxi Province Bureau of Geology and Mineral Resources over the past 4 years have increased raw coal reserves by almost 20 billion tons. A large- and a medium-scale coal mining region prospecting report and five large mine sample prospecting geology reports have been completed. Moreover, only a little more than a year was needed from the start of the project to submission of the reports. It must be acknowledged, however, that the urgent demands of

production departments have rushed prospecting projects and it frequently the case that exploratory drilling projects have gotten underway before the overall design has been submitted and approved. Such disorganization in projects has created a certain degree of passivity in the normal progress of geological work. These lessons should be remembered in future work.

III. Comprehensive Mineral Exploration, Comprehensive Utilization, Improved Socioeconomic Results

There are several useful paragentic (and associated) minerals in Shanxi's coal system strata, including bauxite, pyrite, kaolinite, Shanxi-type iron ore and others. Shanxi has 40 percent of China's total bauxite reserves. Pyrite and superior quality kaolinite are found widely and are Shanxi's most advantageous mineral resources. This makes comprehensive mineral exploration very practical and important in coal field surveys and prospecting. This inevitably will provide excellent benefits for mineral exploration and improved socioeconomic results. Prospects surveys in the northern part of the coal field are an example. Attention was given to comprehensive mineral exploration and the use of surface engineering and drilling data to estimate prospective bauxite reserves in excess of 100 million tons. Another example is the high-quality bauxite in the Huoshangou mineral region discovered during exploratory drilling which occurs in thickness exceeding 9 m.

In the area of comprehensive utilization, coal itself also has accomplished much. More than 80 elements have been found in coal to date, including many rare and scattered elements that have attained industrial grades (like Ge, Ga and so on). These elements are greatly concentrated in coal ash left after the coal is burned, and have created the conditions for industrial recovery and utilization. Finding ways to achieve comprehensive utilization of coal resources is the unshirkable duty of all geological workers, particularly testers. Many departments have studied comprehensive utilization of coal in the past. Examples include the use of coal gangue as a raw material in ceramics, bricks, and cement, extraction of Ge, Ga, U, V, and so on. As modern S&T develop, however, there will be fewer and fewer rich surface ores, easily dressed ores and single ore types, and more poor, mixed and hard-to-dress ores. Often, single ore dressing methods will not meet the needs of comprehensive utilization, and it is hard to attain acceptable results. As a result, the need for comprehensive utilization requires that the professional standards of experimental workers be improved, that advanced technologies and equipment be imported, and that the range of services be continually expanded.

Although coal has great potential as a resource for comprehensive utilization, and backwardness of certain links in China's industries and the lack of the corresponding facilities have caused some useful materials mixed with waste gas and waste liquids to be discharged into the atmosphere or water, creating serious environmental pollution and causing hazards. For this reason, we should start with comprehensive utilization of coal resources and transform disadvantages into advantageous by changing from single minerals to multiple minerals and making a greater contribution to construction of the Shanxi energy, heavy industry and chemical industry base area.

12539/12232

SHAANXI'S SHENFU FIELD NOW BIGGEST IN CHINA

40130038 Hong Kong ZHONGGUO XINWEN SHE in Chinese 0943 GMT 15 Dec 87

[Text] Beijing, 15 Dec (ZHONGGUO XINWEN SHE)--According to information from the Ministry of Coal Industry, the verified coal-bearing area in Shaanxi's Shenfu coal field has again been increased by 3,230 square km, increasing coal deposits by 8.8 billion tons and bringing total coal deposits to 132.18 billion tons. Shenfu thus ranks as the biggest coal field in China to date.

The area of Xinmin recently verified as containing coal covers 17 villages extending into the two counties of Shenmu and Fugu, north of the Shenfu coal field. There are rich coal deposits within an area of 3,000-odd square km, possessing such characteristics as the coal not lying deep and being of good quality and mining being easily carried out.

The Shenfu mining area contains a total of 28 coal seams, with a total thickness of 29 meters. Of the 28, there are 5 main seams from which coal can be extracted. The quality of the coal is marked by low sulfur and phosphorus content and a low combustion point. There is also coal with a high calorific capacity, good for power-related and chemical industries. The greatest depth of the coal seams does not exceed 430 meters. At the edges of the mining area, coal seams frequently meet the surface. The area meets the requirements for the building of a modern mining area allowing large-scale mining.

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BRIEFS

NORTHEAST PRODUCTION--As of 20 December, coal mining administrative bureaus under the general coal company of Northeast China and Nei Monggol produced 101.47 million tons of raw coal, fulfilling the annual raw coal production plan 11 days ahead of schedule. The company's coal production accounts for 25 percent of the total coal production of collieries whose products are distributed under the state unified plan. [Summary] [41030038 Changchun Jilin Provincial Service in Mandarin 2200 GMT 20 Dec 87 SK] /6662

BIG ANHUI FIND--Beijing, 21 November--According to ZHONGGUO DIZHI BAO [CHINA GEOLOGY NEWS], a rich coal field has been discovered in Wanbei, Anhui Province. The Anhui Bureau of Mines recently disclosed that this reserve, located some 1000 meters below the surface, may contain as much as 22.3 billion tons, or twice the amount of the Huaibei and Huainan fields now being mined. The discovery of these reserves brings Anhui Province a step closer to being an energy base for eastern China. [Summary] [40130034 Beijing RENMIN RIBAO in Chinese 21 Nov 87, p 1] /12232

OIL, GAS PRODUCTION INCREASES

40100006 Beijing XINHUA in English 1037 GMT 31 Dec 87

[Text] Beijing, 31 Dec (XINHUA)--By today China has produced more than 978.2 million bbl of oil and 13.7 billion cubic meters of natural gas this year, 2.6 and 2.4 percent more than in 1986, respectively.

After 12 years of stable production, the Daqing oilfield in northeast China produced 405.15 million bbl of oil in 1987. Annual production for China's second-largest oilfield, at Shengli in the eastern part of the country topped 230.68 million bbl. The Liaohe oilfield in northeast China turned out a total of 84.22 million bbl in the year.

In 1987 China found new oil deposits both in the eastern and western parts of the country. The proven deposit east of Urumqi City, in the Xinjiang Uygur Autonomous Region, reached about 2,920 million bbl. High-yield oil deposits were also found in Baise Prefecture, in the Guangxi Zhuang Autonomous Region, which experts believe is a breakthrough in oil exploration in South China.

An official at the oil industry ministry pointed out that China's oil industry suffered shortages of funds and electricity in 1987. Moreover, a few oilfields in eastern China suffered from snowstorms and floods. But the country still exceeded the annual oil production plan.

The official said that in 1988 China will further intensify oilfield construction and pay more attention to technology in a bid to lay a solid foundation for producing 1,095 million bbl of oil and 15 billion cubic meters of natural gas before 1990.

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XINJIANG CALLED 'KEY TO FUTURE OF OIL INDUSTRY'

40100001 Beijing XINHUA in English 1442 GMT 16 Dec 87

[Text] Beijing, 16 Dec (XINHUA)--"The future of China's oil industry is in the northwest, specifically the Xinjiang Uygur Autonomous Region," Wang Tao, petroleum industry minister, said in today's CHINA PETROLEUM JOURNAL.

According to the journal, three large oil deposits in Xinjiang, which accounts for one-sixth of the country's territory, hold 204 billion barrels of crude, or one-third of the nation's total.

These three areas are the Tarim Basin in southern Xinjiang, and the Jungar and Turpan Basins in the north, which cover 739,000 square kilometers. The Tarim Basin is the country's largest and covers 560,000 square kilometers.

Three oil0 and gas-bearing regions and two sites suitable for prospecting have been discovered in the Junggar Basin, the report said, while the Karamay oil field in the basin's northwest sector, where prospecting has been going on for more than 30 years, still strikes new deposits.

Because of complicated geological conditions and inadequate technology, no geophysical prospecting was done in the Tarim Basin's 330,000-square-meter Taklamakan Desert until 1983.

To date, several oil-bearing structures covering over a thousand square meters in addition to a group of smaller ones have been located in the desert, while promising, high-yield oil and gas test wells have been tapped along the desert's edge.

In the Turpan Basin, a few shallow wells were drilled in the 1950's, but not much has been done since the early 1960's, when China's oil industry shifted its focus from the west to the east.

Large-scale oil prospecting and development resumed in 1978, and since then the Turpan Basin has located as many oil reserves as the area did during the previous 28 years.

In the Huoshao Mountains and North Santai areas near Urumqi, the region's capital, 2,92 billion barrels have been located.

9738

OIL, GAS PROSPECTS OF HAILAR, ERLIAN BASINS EVALUATED

40130011 Beijing ZHONGGUO DIZHI [CHINA GEOLOGY] in Chinese No 8, 13 Aug 87 pp 7-9

[Article by Wang Tonghe [3769 0681 0735] and Feng Peiguang [7458 1014 0342] of the Ministry of Petroleum Industry Geophysical Prospecting Bureau: "Oil and Gas Resources and Prospects in the Hailar and Erlian Basins"]

[Text] For a long time, restricted prospecting methods and measures caused differences of opinion concerning the texture, structure, oil and gas bearing properties and other aspects of the Hailar and Erlian basins. The substantial amount of geological, geophysical and exploratory drilling work done in this region in recent years provides rich data for understanding the structural layout and oil formation conditions of these basins. It indicates that the Hailar and Erlian basins are a region of very hopeful oil and gas prospects in China. This article will use comprehensive analysis of the petroleum geology characteristics as a foundation to examine the oil and gas resources and prospects of the basins.

I. Petroleum Geology and Structural Characteristics

The Hailar and Erlian basins are Hercynian folding region fault-subsidence basins. Tension stress field effects on a background of regional uplifts have caused frequent fracturing and subsidence in the mass since the late Mesozoic. The structures in the basin mainly track or accommodate to NE and NNE-oriented fractures or form echelons associated with NW and WNW-oriented fractures. The latter cut off or occlude the NE and NNE-oriented fractures and jointly form a group of grabens, half-grabens, or dustpan-shaped basins. The southward extension of the basins is restricted by the effects of E-W oriented Yinshan old structures. The basins, which are located near the Xar Murun He deep fracture, gradually turn in an ENE or nearly E-W direction, but the overall development of the basins is a NE and NNE-oriented echelon distribution.

Both the Hailar and Erlian basins are formed of almost parallel fault-subsidence zones with a long and narrow central uplift zone. The area west of the Sonid central uplift zone in the Erlian Basin is an example. Moving from north to south, there are the Bayan Dulan, Ehebaolige, and Naomugeng grabens. This is the western fault-subsidence zone. There are more than 60 secondary grabens along the fault-subsidence zone in this region. Although they are of individual shapes and varying sizes, there are close inherent relationships between them in the mechanical properties of the fractures, time of origin

and planar distribution, indicating that they are the products of a unified stress field. For this reason, they have a rather complete structural image. In horizontal cross-section, most of the grabens are horizontally asymmetrical. Most of the grabens to the west of the central uplift zone have western fractures and eastern overlaps, while the grabens to the east have eastern fractures and western overlaps. With the central uplift zone as the axis, they form an almost symmetrical shape. This has aided in differential tilting movement of the fault blocks and accelerated unidirectional slippage or bidirectional extension of the symmetrical tilted fault blocks. This created the rise in the central uplift zone and caused the sedimentation centers to migrate along either side of the uplift. As a result, the grabens nearest the central uplift zone developed earlier and on a larger scale, and they have fully-developed strata and strong oil generation capacities. They vary in the direction of force, size and rock media, however. This is especially true of the sustained, slow rise of the Da Hinggan Ling uplift region on the eastern side of the basins, which accelerated development of the grabens in the western fault-subsidence zone. The development of the grabens in the eastern fault-subsidence zone, however, was restricted. Thus, most of the grabens in the western fault-subsidence zone had the conditions for oil generation while most of the grabens in the eastern fault-subsidence zone had the conditions for coal formation. There are obvious indications of this in seismic profiles of different depths and it has been confirmed by data from a large amount of exploratory drilling.

II. Analysis of Oil Generation

1. Oil generation conditions: According to seismic and exploratory drilling data,the upper Jurassic, lower Cretaceous and Tertiary systems can be found in all of the grabens. They generally are from 3,000 to 4,200 m thick and have a maximum thickness in excess of 6,000 m. Examples include the southern Ehebaolige graben in the Erlian Basin, with a maximum thickness of 5,300 m, and the Bei'er graben in the Hailar Basin, where they are 6,300 m thick. The sedimentation characteristics are: a rather fast rate of sedimentation, abrupt facies changes and a large thickness gradient interlain with a volcanic complex. Oil generating rock is often extremely developed along one side of the main fractures of the grabens while it thins or disappears rapidly on the other side. The sedimentation centers also had a tendency to migrate toward the fracture side as the grabens developed. According to statistics, most of the grabens have an oil generating thickness of 400 to 1,200 m. The maximum thickness is over 2,000 m. The maximum thickness of a single stratum exceeds 290 m. Organic matter generally tends to be abundant. Most have an organic carbon content of 1.2 to 2.8 percent and some exceed 3 percent. Chloroform bitumen "A" averages 0.1287 percent and the maximum is 0.4862 percent. Total hydrocarbons in the lower Cretaceous are mostly around 1,280 ppm. The total hydrocarbon/organic carbon ratio is 3.2 to 7.12 and the organic matter tends to become more abundant at greater depths of burial.

The basins have a rather high hydrocarbon conversion temperature gradient. this is closely related to the crustal weakness of the region as well as the frequent and intense volcanic activity. Particularly interesting are the rather high ground temperature gradient values in the grabens near either

side of the central uplift zone (most are 4.1 degrees C/100 m and some are as high as 6.2 degrees C/100 m). The oil generation window limits are rather shallow (1,200 to 1,300 m) and the oil generation parent rock also is of rather good quality (types I-II). In more distant areas, the ground temperature gradient value becomes successively, lower (2.8 to 3.1 degrees C/100 m), the oil generation window limits correspondingly become deeper (1,500 to 1,750 m) and the oil generation parent rock types are poorer (types II-III). This understanding of the regularities led to discussions on the concept of continental rifting extension and theories of structural migration. As petroleum survey and prospecting work continues to intensify, this understanding will be supplemented, tested and verified. this is of extremely great theoretical and practical significance for deployment of geophysical and exploratory drilling projects and for speeding up the search for zones of rich oil and gas accumulation.

2. Reservoir conditions: The grabens are narrow and deep, while the horsts are wide and long. There often are substantial geomorphological contrasts on one side of the main fractures as well as extensive weathering and denudation. Transport distances were short and the sediments filled in quickly. This facilitated the formation of alluvial fans, submarine fans and other types of sand and conglomerate accumulational bodies. The sandstone strata are mostly 50 to 170 m thick and have a permeability of 100 to 800 milliDarcys and a porosity of 20 to 30 percent. Besides the sandy conglomerate sedimentary bodies, there also are various types of corrosion pores, structural ruptures and paragenetic mixed reservoir bodies characterized by corrosion and transformation. This is especially true of the primary and secondary pores in the igneous rock, which are one of the most important reservoir categories in the region. This is confirmed by the many industrial oil flows in wells in the Arxan structural zone in the Erlian Basin, which is rich in oil and covers a large area to an extent seldom seen in the petroliferous basins of eastern China. This makes it realistic to use seismic, magnetic and other data to study the depth of burial shape, scale and laws of spatial distribution of the volcanic rock bodies to increase oil and gas resource reserves quickly.

3. Entrapment conditions: More than 1,000 structural and stratigraphic traps of various types covering more than 10,000 km^2 have been discovered in this region through gravitational prospecting and seismic stratigraphy. Most of the structural traps have a range of 300 to 500 m and are buried at depths of 800 to 1,200 m. They come in more than 10 types including fault anticlines, bedrock growth anticlines, buried hill fault blocks, rolling anticlines, compression anticlines, draped anticlines, volcanic diapers and others. The stratigraphic traps include overlap, thin-out and other categories. These interrelated local structural and stratigraphic traps form the basic typology of this region. They often appear in clusters and belts in identical structure-sedimentation environment locations in the basins and form a sequence of associated hydrocarbon or oil and gas pools. As a result, research should be strengthened concerning the attributes, laws and distribution of the secondary structural zones as well as their formational mechanisms. This is especially true for those secondary structural zones where industrial oil flows have been seen. Continued exploratory drilling along them may enable rapid discovery of additional oil and gas pools.

4. Oil formation components and categories of oil pools: the degree of rich oil and gas accumulation and preservation in the basins is determined by the temporal and spatial organic components and configuration of oil generation, reservoiring and entrapment. Successive structural movements played an important controlling role in oil generation and reservoiring at different times, levels and dimensions and in the development and distribution of capping strata and their combination and configuration. Exploratory drilling and comprehensive analysis indicated that three types of oil and gas pool combinations have been found in the region.

1) Oil generated in new rocks and reservoired in old rocks. This refers to a combination of upper Jurassic and lower Cretaceous oil generating rock, underlying bedrock fault block reservoir strata, particularly the Hinggan Ling group igneous rock weathered crust, and the above-mentioned strata or mudstone within them as capping strata. Most of the Abei oil pools are of this category.

2) Oil generated in old rocks and reservoired in new rocks. This is a petroliferous combination of upper Jurassic, lower Cretaceous, and Tertiary reservoir strata. It is entirely possible that oil and gas generated in the underlying bedrock may have migrated along fault surfaces, unconformities and sand bodies to accumulate under the capping strata above, or new structural movements may have destroyed oil and gas pools generated in new rock and reservoired in old rock and readjusted them to form oil pools generated in old rocks and reservoired in new rocks. The greatest possibility for this type of oil and gas pool is in the western Hailar Basin, and they actually have been discovered in the northern Erlian Basin.

3) Oil generated and reservoired in the same rock. Oscillating basin subsidence and cyclical changes in lithology created a regular overlaying configuration of generating, reservoir and capping strata. This made formation of this category of oil pools easiest in grabens where no fracturing occurred. According to exploratory drilling and seismic data, there is an obvious recurrent stratigraphic sequence of oil generating strata, sandstone reservoir strata and mudstone capping strata in upper Jurassic and lower Cretaceous strata. This provides very good conditions for oil generation and reservoiring in the same rock. Analysis of oil generating rock samples from wells in the Hailar and Erlian basins shows they have identical parameters and belong to a common source, indicating that they are typical oil and gas pools generated and reservoired in the same rock.

III. Understandings and Suggestions

the Mesozoic Hailar and Erlian basins are the products of crustal extension. The basins cover a large area, have deeply subsided faults and developed over long periods. Internally, they are structurally complex and have a structural configuration of two depressions separated by a central uplift. They contain many oil generating strata systems and have rather high concentrations of organic matter. They have experienced frequent and intense volcanic activity. The ground temperature gradient is rather high and hydrocarbon conversion conditions are good. Secondary structural zones developed and

there are many categories of traps. The accumulations are complete and have good properties. Capping strata conditions are even better. The temporal and spatial combination and configuration of these interrelated conditions created extremely favorable geological conditions for the formation of oil and gas pools in this region. As a result, many surface indications of oil and gas have been seen and many wells have encountered thick oil, oil sand and industrial oil flows. To data, full exploratory drilling has been done only in a few of the grabens and the moderate-sized Arxan oil pool was discovered. There is quite a difference, however, between this and the oil and gas resources of the basins. Thus, it is felt that there are rather broad exploration prospects for the Hailar and Erlian Basins and that they contain rather abundant oil and gas resources. As a result, the following recommendations are suggested for exploration:

1) Given the structural layout characteristics of the basins in this region and the laws of graben fault overlap, geophysical and exploratory drilling work should be concentrated in the grabens on either side near the central uplift zones. This is especially true of the grabens on the western side of the uplifts where indications of oil and gas have been seen. Examples include Bei'er graben in the Hailar Basin, Ehebaolige, Bayan Dulan and Naomugeng grabens in the Erlian Basin and others. Moreover, prospecting should be carried out both at shallow and deep levels and there should be a combined search for structural and stratigraphic oil and gas pools.

2) Given the region's variety of graben types, structural complexity, rapid sedimentation rates, abrupt facies changes, frequent volcanic activity and other characteristics, comprehensive research should be reinforced concerning categories of graben structures and on laws of oil and gas accumulation and distribution. This is particularly true of research on the temporal and spatial configurational relationships among generating, reservoiring and capping strata and traps, and on the pattern and time of oil and gas migration. We should work as quickly as possible to develop new realms of oil and gas exploration and discover new categories of oil and gas in different grabens or in different structural locations in them, and in different strata systems.

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1987 OIL PRODUCTION FIGURES--According to the Ministry of Petroleum Industry, China overcame a number of problems to pump 133 million tons of crude oil as of the 29th of December 1987. Through the institution of reform measures and general guidelines, in 1987 the petroleum industry found more oil and gas reserves and construction of new oil and gas fields continued apace. Older fields with stable production actually produced more thanks to the application of new technologies. Both oil and gas production continues to show a steady increase. [Summary] [40130033 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 2 Jan 88, p 2] /12232

PINGHU FIELD GETS PRIORITY--Hangzhou, 22 Dec (XINHUA)--China will start the development of the Pinghu oil field in the East China Sea, according to an official from the Ministry of Geology and Mineral resources. A total of 10 wells sunk by the ministry in the East China Sea have proved to have oil and natural gas. The development of the Pinghu oilfield will be China's first step to develop the East China Sea oil field. Prospecting for oil and gas in the East China Sea started in 1980. Experts from the Ministry of Geology and Mineral Resources suggested preparations should be started as early as possible for the development of the Pinghu oilfield. [Text] [40100001 Beijing XINHUA in English 0227 GMT 22 Dec 87] /9738

JUNGGAR ACTIVITY INTENSIFIED--Urumqi, 13 Dec (XINHUA)--The development of the Junggar Basin oil field in China's far western Xinjiang Uygur Autonomous Region has intensified. About 10,000 oil workers are drilling and exploring the remote region that now lies covered with snow. High-quality crude has started to flow from several dozen oil wells drilled in the Huoshao Mountains area of the basin, an official of the region's oil administration bureau said. Most of the wells are located near villages or cities and thus posing few transportation problems. Large oil and gas deposi-s have been found in surveys of the basin making it the second oil field in the region after the Karamay oil field. A third oil field in the Tarim Basin is being developed. The development of "Junggar oil field" is listed as one of the key construction projects during the Seventh 5-Year Plan (1986-90). Next year, the state will invest 1 billion yuan (270 million U.S. dollars) to build several hundred oil wells there to achieve an annual production capacity of 7 million bbl of crude oil. The Ministry of Petroleum Industry is also transferring skilled workers and advanced equipment from the large oil fields in the country's central and eastern areas to help develop the oil field. The annual output of crude oil in the basin is expected to reach 28 million bbc by 1990. The output for the Xinjiang Uygur Autonomous Region as a whole in 1990 is expected to be about 70 million bbl. Currently the region produces 35 million bbl. [Text] [40100001 Beijing XINHUA in English 1307 GMT 13 Dec 87 OW] /9738

YUMEN YIELDS NEW RESERVES--Lanzhou, December 26 (XINHUA)--The discovery of new reserves has revitalized the Yumen oilfield in northwest Gansu Province, China's oldest oilfield. The reserves are estimated at 100 million barrels and were discovered through a four-year geological study of a 11.53 square kilometer area, oilfield officials said today. The oilfield, tapped 48 years ago, has produced up to seven million barrels a year in the past. During the 1980s, however, declining reserves cut the oil output to only about half that amount. But one of the new wells is now turning out more than 700 bbls a day, the officials said. Oil experts have estimated oil reserves in the Jiuxi Basin where the Yumen oilfield is located at between 840 million bbls and 1.19 billion bbls. [Text]]41000005 Beijing XINHUA in English 0820 GMT 26 Dec 87 OW]/6662

SHENGLI FINDS MORE RESERVES--Beijing, December 22 (XINHUA)--Oil prospectors discovered an additional 1,050 million barrels of oil reserves from March to November this year in the Binhai Oilfield in Shandong Province, part of the Shengli Oilfield, China's second largest. The new reserves are scattered over an area of 2,700 square kilometers on the northern bank of the mouth of the Yellow River. Oil and gas layers were found in 59 of 78 test wells, today's overseas edition of the PEOPLE'S DAILY reported. The Binhai Project hopes to develop some larger oil zones over the next 3 years. The Shengli Oilfield produced 206.5 million barrels last year and is targeted to produce 280-350 million barrels in 1990. [Text] [41000005 Beijing XINHUA in English 1228 GMT 22 Dec 87 OW] /6662

FUJIAN, HAINAN MAY BUILD NUCLEAR PLANTS

40130036 Hong Kong ZHONGGUO XINWEN SHE in Chinese 1028 GMT 8 Jan 88

[Report by Qin Lang [4440 2597]: "Feasibility Study of Building Nuclear Power Stations in Fujian and Hainan Completed"]

[Text] Beijing, 8 Jan (ZHONGGUO XINWEN SHE)--This reporter learned from the Chinese Ministry of Nuclear Industry today that the department concerned is considering cooperating with foreign countries in building nuclear power plants in Fujian and Hainan. The initial feasibility study of building nuclear power plants in Fujian and Hainan has been completed.

The feasibility study was conducted and completed by the No 2 Research and Design Institute of the Ministry of Nuclear Industry. As disclosed by Liu Guoming, director of the institute, the ministry will selected a 900,000-kilowatt pressurized-water reactor and another 600,000-kilowatt pressurized water reactor for the building of a nuclear power plant in Fujian Province; and a high-temperature gas-cooled reactor, which is more advanced than the former, will be used for the construction of a nuclear power plant on Hainan Island. These two projects are awaiting approval from the State Council.

The No 2 Research and Design Institute of the Ministry of Nuclear Industry is the largest organ engaged in the research and design of nuclear projects in China. Since its founding 30 years ago, engineers and technicians of the institute have undertaken the technological introduction and design of major projects such as plutonium production reactors, nuclear fuel components factories, nuclear fuel post-processing facilities, uranium isotope separation factories, and nuclear weapons manufacturing bases.

It has been reported that the institute has in recent years conducted a feasibility study on the building of nuclear heat supply plants in Lanzhou and Qiqihaer and has shared its efforts in the preparatory work for the construction of the second phase of the Qinshan nuclear power plant projects, which will be installed with two 600-,000-kilowatt pressurized water reactors.

Two nuclear power stations are now under construction on the Chinese mainland. One is the Qinshan nuclear power plant in Zhejiang Province and the other is the Daya Bay nuclear power plant in Guangdong Province. Li Peng, acting premier of the State Council, said earlier that China will build as many nuclear power plants as it is able in the eastern regions of the country, which are short of energy.
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STATUS OF RURAL ENERGY CONSTRUCTION REVIEWED

40130020 Chongqing XIN NENG YUAN [NEW ENERGY SOURCES] in Chinese Vol 9, No 10, 5 Oct 87 pp 1-3

[Article by Li Mengming [2621 1382 6900]: "A Survey of Rural Energy Construction in China"]

[Text] During the Sixth 5-Year Plan, rural energy construction in China adhered to the principles of "adaptation to local condition, mutually complementary multiple energy resources, comprehensive utilization and concern for actual results" and made obvious achievements. According to statistics, 35 million mu of fuel forests were added and the installed generating capacity in small hydropower stations increased by 2.5 million kW. The number of households using biogas increased by 2.5 million and wood and coal-saving stoves were popularized among 40 million households. With the added substantial progress in development and utilization of solar, wind, geothermal and other energy resources, the energy conservation capacity and newly-added energy resources were equivalent to 20 million tons of standard coal. The firewood-saving capacity in wood and coal-saving stoves, biogas pits and solar cookers alone was equivalent to 11 million tons of standard coal. Output from small rural coal pits also has grown considerably. Some of China's rural areas have made initial improvements in the household fuel shortage situation.

It was decided at the National Rural Work Conference in March 1986 that rural energy construction in China would continue to adhere to these principles during the Seventh 5-Year Plan. Only the need to adapt to the situation caused the previous formulation of "concern for actual results" to be changed to "concern for results." A decision was made to continue active development of fuel forests, to make major efforts to popularize wood and coal-saving stoves and maintain stable development of biogas, to develop small-scale hydropower, small coal pits and small-scale thermal power in areas with the proper conditions, to carry out good trial applications of wind, solar and geothermal energy in rural areas, and to work for good conservation work for commodity energy resources in rural areas. The work focused on popularization of wood and coal-saving stoves.

Nineteen eighty-six was the first year of the Seventh 5-Year Plan. Implementation of the aforementioned principles and a focus on results led to even more obvious achievements rural energy construction in China by popularizing wood and coal saving stoves and accelerating development of new energy resources. According to statistics, wood and coal-saving stoves were

extended to over 15 million households and an additional 400,000 households are using biogas. With the addition of solar, wind and geothermal energy, trial demonstration counties for rural energy integration and energy conservation in agricultural production, energy-saving capacity and newly-added energy resources equivalent to more than 6 million tons of standard coal were added in 1986. An additional 2 million tons of standard coal were saved during 1986, the first of the Seventh 5-Year Plan, compared to the yearly average savings of 4 million tons of standard coal during the Sixth 5-Year Plan, so rural energy construction in China has accelerated.

Rural energy construction in China at the present time has the following characteristics:

Management, scientific research, production and technical service systems in rural energy construction have taken shape in a preliminary fashion and they are gradually being perfected and completed. Rural energy offices have been established in 32 of China's provinces, municipalities, autonomous regions and cities with province-level economic decisionmaking authority. Some provinces and municipalities have included capital and materials inputs among work tasks for rural energy construction. In the area of scientific research, China has 162 scientific research units and institutions of higher education related just to solar energy and they have more than 3,000 S&T personnel. More than 50 plants are producing equipment for solar energy utilization. There are more than 1,500 rural energy technical service companies at the county and prefecture levels which are responsible for administering, managing and maintaining energy machinery and tools. Work is exceptionally lively in these service companies. The gross volume of business during the single year of 1986 exceeded 100 million yuan and profits were over 10 million yuan. They have contributed to serving the peasants, technical training, quality assurance and other areas.

Rural energy construction has begun to expand from the household realm to the production realm, and it is concerned with improving overall economic results. Many provinces and municipalities are actively engaged in improving roasting technologies by improving the stoves used in curing tea, and tobacco and drying farm and sideline products, which has provided excellent results by conserving large amounts of wood and coal. Farm machinery, aquaculture and reclamation departments are adopting various measures to conserve coal and electricity. Some regions are moving from small peasant household biogas tanks to development of large and medium-scale biogas projects for state farms, livestock farms and plants.

A situation of multilayer utilization has appeared in the area of biological energy development and utilization. Multilayer bioenergy utilization refers to the organic integration of bioenergy utilization with cropping, breeding, environmental improvement and biogas. Poultry manure is used to make a mixed feed for hogs. The hog manure and urine produces biogas for cooking and making feeds. Biogas fertilizer is used to grow crops. Biogas dregs are used to raise fish and for raising loaches and breeding earthworms. The earthworms in turn are used to make a feed for raising poultry and hogs. This forms a production line that is an ecologically benign cycle. the Changsha Institute

of Agricultural Modernization in the Chinese Academy of Sciences has done simulated experiments on multilayer bioenergy utilization in a five-member peasant household. They built an $8m^3$ biogas pit that can produce $1.5m^3$ of biogas daily which can feed 50 chickens and raise 10 or 11 hogs. The poultry manure can be substituted for 30 percent of the hog feed and the hog manure and urine can produce biogas for household cooking needs. The fertilizer and dregs can be used to raise mushrooms, breed earthworms and plant vegetables and melons. The result is sa nitrogen utilization rate as high as 93.64 percent through multilayer utilization. Rather good utilization of the carbon in the organic matter also is achieved. A specialized orange-raising household in Nanxian County, Hunan Province with 11 members built a $30m^3$ biogas pit in 1984 which can feed over 100 chickens and raise 20 hogs. Each day there are 10 dan of hog manure and urine for producing biogas. Biogas fertilizer was used to plant orange trees. This provided household energy for the entire family and also brought them bumper orange harvests and 15,000 yuan in income each year. In Xinhua County, Hunan Province, Li Yanwen [2621 5333 2429] and his mother, who have been names "farm family systems engineering pacesetters," raised 45 chickens and 32 hogs in 1985. Multilayer bioenergy utilization gave them a yearly income of more than 8,000 yuan. Many facts have proven that a multilayer pattern of bioenergy utilization is an effective means of providing rural energy supplies and good energy resource use as well as a route to peasant prosperity.

Rural energy construction trials have expanded from the village to the county level and grown from single family responsibility to multi-departmental cooperation. A three-ministry topical group formed from the Ministry of Agricultural, Animal Husbandry and Fishery, the Ministry of Forestry and the Ministry of Water Resources and Electric Power began comprehensive trial rural energy construction work at the county level in 1983 under leadership by the State Economic Commission. They chose Tongliang County in Sichuan Province, Yongchun County in Fujian Province and Dancheng County in Henan Province as the first group of trial counties. Excellent achievements have been made through the cooperative efforts of all the ministries. This joint rural energy trial construction work by the Ministry of Forestry and the Ministry of Water Resources and Electric Power is an example of cooperation among central departments. It has aided in overcoming problems like organizational and topical redundancy, capital decentralization, scattering of forces and so on.

Continued popularization of wood and coal-saving stoves and biogas technologies have been accompanied by accelerated development and utilization of solar, wind and geothermal energy.

Solar energy: According to incomplete statistics, China had about 90,000 solar stoves at the end of 1984, more than half of them in rural areas of Gansu and Hebei. Gansu has the most, about 40,000 units, and Hebei is second with 15,000. About one-third of the stoves, however, are damaged or useless. In northwest China, with its abundant solar energy resources, a $2m^2$ solar stove has an effective power of 800 to 1,000W. This basically can satisfy the cooking needs of a five-member peasant household and conserve fuel equivalent to 400 kg of standard coal each year. More than 300,000 m^2 of water heaters

have been built and the scope of their supplies as expanded steadily from the initial focus on supplying low-temperature heated water for public activities in urban areas to industrial and agricultural production realms like washing technical products, low-temperature fermentation, hot water supplies for dairy cattle barns and so on. Experience in actual use confirms that each square meter of hot water heater can save 200 to 300 kg of coal each year. China has completed more than 130 solar houses of various types. Most of them are located in northwest and north China. Based on differences in construction regions and structural shapes, the room temperature inside a passive solar house can be held at 8 to 12 degrees C, with solar heat providing 50 to 80 percent. Each additional square meter costs 10 to 25 yuan to manufacture. China's rural areas are in a new stage of housing renovation. Besides integration with rebuilding rural houses and popularizing wood and coal-saving stoves, consideration also can be given in heating regions with abundant solar energy resources to directly beneficial insulated energy-saving houses. In addition, development and research work on insulating materials and window and door insulating curtains should be reinforced. China had about 1 million mu of various types of solar energy greenhouse and plastic shed structures at the end of 1983. Solar energy greenhouses are used mainly to raise more than 60 varieties of vegetables. The uses for solar energy greenhouses now have been expanded to include poultry and hog raising, fish and shrimp raising, silkworm raising and other shifts toward comprehensive utilization and economic diversification. The survival rate for fish fingerlings raised in solar energy greenhouses can be as high as 99.5 percent, a 30 to 50 percent improvement over greenhouses heated by burning coal. Solar energy heated beds for raising crop seedlings usually can raise yields by 6 to 15 percent. Solar heating of pig pens can increase the number of litters per sow from two in 1 year to five in 2 years, and it also increases the slaughter rate of fattened hogs. Solar heated pens now are being used for raising dairy cattle, lambing and other purposes in Shanxi, Nei Monggol and other areas. More than 50 solar energy dryers have been built for drying grains, fish, meat, tobacco, fine noodles, dried bean milk cream, fruits lumber, hides, herbal medicines, rubber, silk and other materials. The drying time usually is reduced by two-thirds and product quality is better compared to natural drying and traditional drying methods. Three solar energy seawater desalination facilities have been built on Hainan Island, Xisha [Paracel] Zhongjian Island and in Zhejiang Province, and their operation is excellent. China had 180 kW of solar batteries in use at the end of 1985. This figure rises to 200 kW if one includes the 10 kW solar battery water pumping station built in cooperation with the Federal Republic of Germany in Yihe Hamlet, Daxing County in Beijing Municipality and the 10 kW solar battery rural lighting system built in cooperation with Japan near Lanzhou in Gansu Province. This includes about 90 kW being used as a power source for black lights, electric fences, water pumps, illumination and television in agro-pastoral and frontier regions. A solar energy battery charging station with a 5 kW maximum capacity also was built in Fukang County in the Xinjiang Uygur Autonomous Region in 1986. However, the manufacturing cost of solar batter components in China is about 50 to 55 yuan per peak watt, which still is too expensive. The key to popularization of solar batteries throughout China's urban and rural areas is the need for substantial reductions in manufacturing costs.

Wind energy: Development of 50 to 100 W mini-windmills key project in the Sixth 5-Year Plan, has been completed on schedule and they are being produced in large amounts. More than 10,000 of them are being used in Nei Monggol alone. Two types of wind-powered water lifting machinery, high-lift small flow rate and low-lift large flow rate, have been developed and they passed technical examinations in 1985 in Nei Monggol and Jiangsu Province. In winds of 7 to 8 meters/second, the lifting and flow rates are 50 to 60 meters at one ton/second and two meters at 60 tons/second, respectively. Two different models of 3kW wind-powered generators passed technical examinations at the end of 1985 and will go into operation after field testing during the Seventh 5-Year Plan. Initial achievements have been made in the development of 15, 20 and 50 kW wind-powered generators in various locations.

Geothermal energy: The focus during the Sixth 5-Year Plan was on construction of the Yangbajing geothermal power station in Xizang. It has an installed generating capacity of 10,000 kW and passed technical examination in July 1985. It now is in full operation and has become an important source of electricity for urban and rural areas in the Lhasa region and is playing an enormous role in economic construction and the people's livelihood in the area. Low temperature geothermal utilization points have been built in Liaoning, Tianjin, Hebei, Hubei, Fujian and other places. The geothermal energy is used during the winter for raising vegetables and melons, breeding improved varieties, raising fish and eels, incubating poultry and other purposes. It has provided rather good economic and social results. Some units are studying multilayer comprehensive utilization of geothermal energy and it may become an even more effective means of geothermal energy utilization in the future.

Although obvious achievements have been made in rural energy construction in China and the firewood shortage has been alleviated in some rural areas, the rural energy shortage has not been solved in China as a whole. As reforms in China's rural areas progress, the peasants' rising material and cultural living standards will increase demand for energy supplies. This is particularly true of the rapid development of township and town enterprises. Rural household energy supplies as well as energy used in production must be dealt with properly. The tasks of rural energy construction in China still are very difficult and we must work together and continue to focus on the strategic issue of rural energy.

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